DOCUMENT RESUME

ED 096 115 SE 018 011

| | |
|---|---|
| AUTHOR | Wheeler, Elaine |
| TITLE | St. Marks High School General Biology Course. |
| INSTITUTION | Delaware State Dept. of Public Instruction, Dover.; Del Mod System, Dover, Del. |
| SPONS AGENCY | National Science Foundation, Washington, D.C. |
| REPORT NO | NSF-GW-6703 |
| PUB DATE | [73] |
| NOTE | 91p. |
| EDRS PRICE | MF-$0.75 HC-$4.20 PLUS POSTAGE |
| DESCRIPTORS | *Biology; Curriculum Guides; Instruction; *Instructional Materials; Learning Disabilities; Science Education; *Secondary School Science; *Slow Learners; *Teaching Guides; Units of Study (Subject Fields) |
| IDENTIFIERS | *Del Mod System |

ABSTRACT

This unit of instruction consists of a general biology course for secondary school students with learning disabilities or who are reluctant learners. All units include the objectives, list of new words and a list and type of activities to achieve the objectives. Student participation is emphasized. The students choose the type and sequence of the exercises to be done. Better readers help poorer ones. Students determine the number of activities they complete in each unit. The materials to be used and the source from which they can be obtained are presented. The evaluation process is outlined and a progress record form included. Each learning activity includes an introduction, presenting the concept to be learned, the purpose, the necessary materials and procedure, as well as a student report sheet. Extra credit activities and optional learning experiences are provided. (EB)

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# ST. MARKS HIGH SCHOOL
# GENERAL BIOLOGY COURSE

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ST. MARKS HIGH SCHOOL

*Printed and disseminated through the office of the Del Mod Component Coordinator for the State Department of Public Instruction, John G. Townsend Building, Dover, Delaware 19901*

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Preparation of this monograph was supported by the National Science Foundation Grant No. G.W. 6703 to the Del Mod System, P. O. Box 192, Dover, Delaware 19901

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# GENERAL BIOLOGY COURSE - ST. MARKS HIGH SCHOOL

## RATIONALE

1. To provide a comprehensive course in a simple, interesting manner to students with learning disabilities or reluctant learners.
2. To present a wide variety of exercises to challenge the best of the group but not discourage the poorest.
3. To enable all students to achieve some level of success to build confidence.

## PROCEDURE

1. All units begin with the distribution of a Progress Report containing:
   a. Objectives for the unit
   b. List of new words
   c. List and type of activities to achieve the objectives

2. Student participation
   a. Selection of team and group members each semester
      1. Students work in teams of two, occasionally in groups of four
   b. Each team chooses the type and sequence of the exercises they do
      1. Develops responsibility and cooperation
      2. The better reader helps the poorer one
      3. The confident student supports the timid one.
      4. The discussion reinforces learning.
   c. The students determine the number of activities they complete in each unit
      1. Students who have been absent may bring in a team mate or a friend to help them make up lost work
      2. Students excused for driver education, special projects, field trips, etc. come in on free mods.
      3. Each unit contains CHALLENGE MATERIAL for especially interested students, who are always free to come in during free mods as long as there is an empty place in the room.

## MATERIALS AND SOURCES

1. Packets of transparency, cassette tape, tape script, learning activity and report sheet in a Duo-tang binder
   a. Transparencies; Milliken Publishing Company, 611 Olive

Street, St. Louis, Missouri 63101
b. 30 min, tapes from the Tape Hut

2. Typed learning activities and report sheets for a variety of types of lessons

3. Tape recorder or player; Lafayette RK-79 @ $32.95 or RK-68 @ $24.95 or Craig player @ about $20.
   a. listening post: homemade @ $4.28
   b. headsets: Tape Hut SN-01 @ about $6.

4. Microviewers and filmstrips: National Teaching Aids, Inc. 120 Fulton Avenue, New Hyde Park, New York 11040 @ $2.00 and $1.50 respectively.

EVALUATION

1. Students complete the exercises for each lesson and a student checker does the preliminary correcting.
   a. Develops responsibility and honesty
   b. Reinforces learning
   c. Boosts self-image

2. The instructor rechecks, assigns the grade, and records the mark on the Progress Report Sheet
   a. Immediate reward of the grade is encouraging
   b. Most exercises are sufficiently easy for the students to achieve a good mark - a great morale builder - Nothing succeeds like success.

3. Grades for quarters
   a. Four criteria are measured Q A W Q
      1. Quality of the work submitted
      2. Attitude - responsible and independent performance of activities
      3. Work - careful, quiet, clean, and neat report
      4. Quantity of work completed

4. Students evaluate their own achievement and attitude after each unit.

5. My evaluation of this approach
   a. The students are interested.
   b. They are challenged and are striving to meet the challenge.
   c. The non-readers are reading the tape script as they listen in order to have better success in finding the answers to the activites.

d. The students are attempting to read and follow directions independently.

e. For the first time in many years of working with the lower level student, I find the students interested right up to the end of the year. I think this is due to many things including the variety of materials, differences in types of lessons and media used and gentle, but firm, encouragement and/or prodding from the instructor, and most important, the improved self-image due to the success achieved and relished.

GENERAL BIOLOGY



# SCIENTIFIC TOOLS

Name _____ Section _____ Date _____ Instructor _____

1. OBJECTIVES: At the end of this unit, students should be able to:

    1. collect and record data.
    2. graph data.
    3. interpret graphs.
    4. identify the major parts of a compound microscope.
    5. calculate magnification.
    6. make a slide and focus it under low and high power.

REQUIRED NEW WORDS

verticle axis, pipet, horizontal axis, curve, slide, coverslip

PARTS OF THE MICROSCOPE (See Bausch and Lomb guide sheets)

| | | |
|---|---|---|
| arm | body tube | zoom microscope |
| base | coarse adjustment | fine adjustment |
| clips | compound microscope | illuminator |
| lens | disc diaphragm | object |
| stage | eyepiece | objective |
| field | magnification | resolving power |

THIS PROGRESS RECORD IS NOT TO BE TAKEN OUT OF THE ROOM.

SCIENTIFIC TOOLS

Name _____ Section _____ Date _____ Instructor _____

| NUMBER | TITLE | DESCRIPTION | CHECK | COMMENTS |
|---|---|---|---|---|
| 1.01 | Collecting Data | Lab | | |
| 1.02 | Graphing Data | Class | | |
| | Quiz 1.01 and 1.02 | | | |
| 1.03 | The Compound Microscope | Class | | |
| 1.04 | Making Slides | Lab | | |
| | Challenge Material | | | |
| 1.06 | Review Graphing | | | |
| | Test | | | |

TIME: In order to keep live material and fresh solutions available, it is necessary to put a time limit on each unit. All students do not learn at the same rate; therefore, you do WELL as much as you can do in the time allotted. Those who complete all the exercises may try the Challenge Material, but remember, Quality is more important than Quantity.

GRADING:

1. Quality of work submitted
2. Attitude - responsible, independent
3. Work - careful, quiet, tidy
4. Quantity of work completed

REMEMBER 4 ITEMS: Q.A.W.Q.

PROCEDURE: This introductory unit we will work more or less together. If he or she gets ahead of the group, he/she may do the Challenge Material.

# COLLECTING DATA

## I. INTRODUCTION:

Man's breathing is controlled by movement of the diaphragm, the large sheet of muscle between the abdominal cavity and the chest cavity. As it moves up or down, it changes the pressure in the lungs permitting air to rush in or be expelled.

The frog has no diaphragm. It controls the flow of air by moving the floor of his mouth up or down. We can count how often the frog breathes by watching the floor of his mouth. Frogs are cold-blooded animals, that is, their body temperature and other functions change as the external temperature changes.

You will be placing a frog in water and counting the number of up-and-down movements of his mouth. Record these data in the Data Chart. Then you will change the temperature of the water with ice and salt and count the up-and-down movements at several different water temperatures. All of these data will be recorded in the chart.

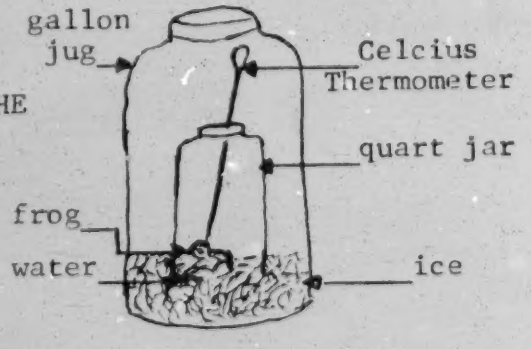
PURPOSE: To observe effect of changes in temperature on the breathing rate of a frog.

## II. MATERIALS:

1. A live frog
2. One quart jar
3. A gallon jug
4. A lid with holes
5. A Celsius thermometer
6. Some crushed ice
7. Table salt
8. Use the clock on the wall

## III. PROCEDURE:

1. Pour 1/2 inch of tap water into the quart jar.
2. Cover the top of the jar with a screw cap with holes punched in it.
3. Put a Celsius thermometer through one of the holes in the top. Make sure the end of the termometer is IN THE WATER at the bottom of the jar.



COLLECTING DATA

4. After a few seconds, read the temperature of the water and record it in #1 in the Data Chart under Temperature.
5. Now quickly, using the second hand on the clock, count the number of times in one minute that the frog's lower jaw goes UP. Don't count the down movements - only the UP movements.
6. Write that number in the First Count line in the chart on the Room Temperature column.
7. Wait one minute. Then count again for one minute. Write the number on the Second Count line. Wait one minute. Count again for one minute. Write the number in the third count line.
8. Now add the three counts together and divide the total by 3. This gives you the Average Breaths/min. Write that number in the place marked Average at Room Temperature in the Data Chart.
9. Place the jar with the frog into a gallon jug. Place as much crushed ice as you can into this large container, so that the jar is about half covered by ice. Arrange the ice in the jug so the frog can be seen.
10. Take the temperature of the water inside the jar. When it has dropped 5 degrees lower than when you started, pull it up out of the ice just enough to keep the temperature steady.
11. Take three one-minute counts, and record them under first count, second count, and third count in #2 column in the chart. Average these 3 counts and record the average below the second column in the Data Chart.
12. Pour 4 tablespoons of salt on the ice in the large container. This will lower the temperature of the ice. Make sure no salt gets on the frog.
13. After the temperature has dropped 5 or 6 more degrees, measure the temperature and record it in #3 column of the Data Chart. Pull the jar up to keep the temperature constant for the 3 counts. Take 3 one-minute counts and record them under First Count, Second Count, and Third Count in Column #3 of the Data Chart. Average these 3 counts and record in the Data Chart.
14. Pour four more tablespoons of salt on the ice in the outer beaker. Allow the temperature to drop 5 or 6 more degrees.
15. Again, measure the temperature of the water inside and record in Column #4 of the Data Chart. Pull the jar up out of the ice if necessary to keep temperature constant while you make the three counts. Record them as before.
16. Clean all lab equipment and materials and return them to their proper places. Remove the frog from the jar and return it to the large container on the supply table.

SAVE YOUR DATA: You will use it in Learning Activity 1.02. Ask your teacher to look over your data and to initial it.

IV. DATA: Record your data on your Report Sheet.

COLLECTING DATA

V. CONCLUSION: Write one sentence to tell what happened in general to the rate of breathing as the temperature decreased.

GENERAL BIOLOGY REPORT SHEET I.A. 1.01

COLLECTING DATA

Name _____ Section _____ Date _____ Instructor _____

1. When a frog breathes, what part of his body do you see moving?

_____

2. Why can he not breathe the way you do? _____

_____

_____

DATA:

| TRIALS | Room Temp. °C | Ice Temp. °C | Ice and NaCl °C | Ice and NaCl +°C |
|---|---|---|---|---|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| AVERAGE | | | | |

CONCLUSION _____

_____

_____

_____

# GRAPHING DATA

## I. INTRODUCTION

In the laboratory activity you did with the frog you collected many facts about the breathing movements of a frog at various temperatures. These facts are called data. A scientist often wants to show his data to other scientists. One of the easiest ways is to make a graph, which is a sort of picture of your data and tells us at a glance what happened in an experiment.

## II. PURPOSE:

1. To learn graphing procedures.
2. To graph the data obtained in Learning Activity #1.01.

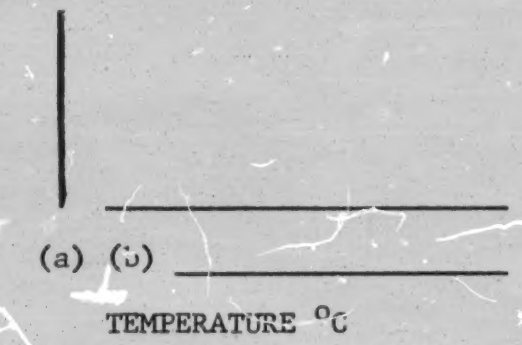
## III. MATERIAL:

1. The information given on this page.
2. The data you collected in Learning Activity #1.01

## IV. PROCEDURE

### A. Preparing Your Graph

1. A graph always has a vertical axis. This is a line that goes up and down. Label the vertical axis on the proper lines on your Report Sheet #II. A graph also has a horizontal axis, a line that goes across the paper. Label the horizontal axis on the proper line.



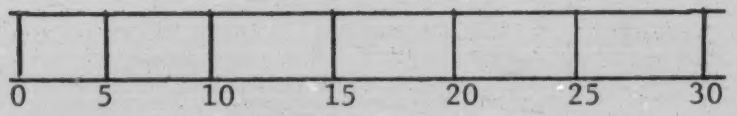

2. In plotting a graph to show how one kind of data relates to another, you always use:
(a) one number (b) two numbers, or a pair (c) three numbers

3. Use these data to make a graph. Put your answers on your Report Sheet. To graph these data, numbers must be placed on each axis. The temperature numbers will be placed on the horizontal, and the breaths/per minute on the vertical. Label the vertical axis breaths/min., the horizontal axis, Temperature °C on the Graph B on the front of your Report Sheet.

4. In this graph we will make each space equal to five degrees Celsius. For example, the first space is five, the second is 10, etc. Notice that the space between each number on the horizontal axis is (a) not the same or (b) equal.

5. Complete the numbering of the horizontal axis on the graph on your Report Sheet. Number as far as will be needed for the data above.

GRAPHING DATA




6. If the numbers on the horizontal axis show the temperature, the numbers on the vertical axis must show

   (a) frog breaths per minute (c) blinks of the frog's eye
   (b) temperature

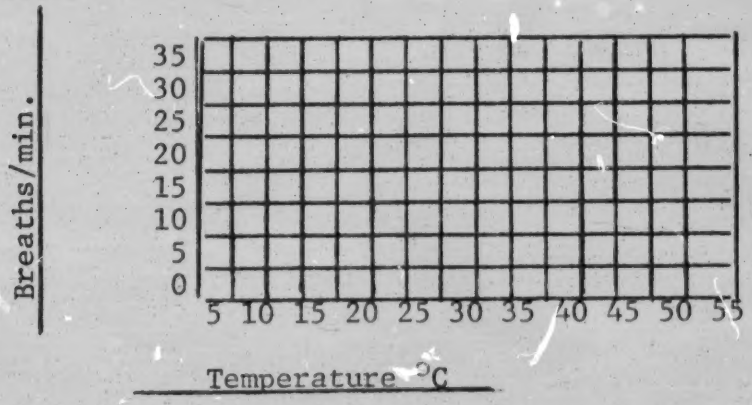
7. Look at the graph below. The space between each line represents how many breaths per minute?

8. Both the vertical and horizontal lines were numbered by fives. Does the vertical axis have to be numbered in the same way as the horizontal axis?

9. Number the lines on the vertical axis on your Report Sheet. You must go as high as necessary to cover the data.

B. RECORDING YOUR DATA ON THE GRAPH:

Beginning with zero, where the two lines meet at the lower left corner each vertical line has been labeled for five frog mouth beats.




| TEMP °C | BREATHS/ MIN. |
|---|---|
| 5 | 6 |
| 15 | 12 |
| 25 | 43 |
| 35 | 60 |
| 40 | 67 |
| 50 | 72 |
| 60 | 75 |

10. Study the data above. When the temperature is 5°C, the breaths per minute are ____. Put the point in the proper place on your graph.

11. When the temperature is 15, the breathes per minute are _____.

12. Continue recording the other five pairs of numbers above on the graph.

GRAPHING DATA

13. You are comparing breaths per minute with the _____ in Celcius degrees.

14. Now draw a SMOOTH CURVE to include as many of the points as possible. If one does not fit in, check to see if you recorded it correctly. If it still does not fit in well, just draw the smooth curve past it.

C. INTERPRETING GRAPHS

15. One of the important things about a graph is that it helps us find other data that we did not actually test. Look at your curve and see if you can find the missing values.
    a. At 10°C, the frog breathes _____ times per minute.
    b. At 30°C, the frog breathes _____ times per minute.
    c. The frog breathes 25 beats/min at _____°C.
    d. The frog breathes 75 beats/min at _____°C.

16. Another important thing we can learn from graphs is how to predict or guess what will happen if we keep testing at higher values. Noting the slope (or angle) of the line as it touches the points at 40°, 50°, and 60°C, extend the line to 70° and 80°C to see how many times per minute the frog would breathe at those temperatures.
    a. At 70°C, the frog breathes _____ per minute.
    b. At 80°C, the frog breathes _____ per minute.

17. Is there as much of a change in the breathing rate between 60° and 80°C as there was between 20° and 40°C? Can you explain this?

IV. GRAPHING YOUR DATA PART II

Make your own graph from the frog data you collected by following these directions:

1. Use the graph in Part IV on your Report Sheet.

2. Copy the data from your frog experiment onto Chart.

3. Organize your data in pairs of numbers from the lowest temperature number to the highest. Use the average breaths/min. Keep the related temperature and breaths/min across from each other.

GRAPHING DATA

4. Number the horizontal axis for the temperature in the same way that you did before. Then, number the vertical axis for the breaths/min.

5. Plot your pairs of numbers and connect them to form a smooth curve.

V. CONCLUSION:
Write one sentence showing the relationship of temperature and breaths per minute in the frog.

CHALLENGE MATERIAL:

1. Obtain the data from two other teams. Record it in different colors on your graph.

2. Did all three frogs breathe at exactly the same rate?

3. Give two reasons which might explain your answer.

4. Find the average breaths per minute:

| ____ $^{o}$ C | breaths/min. | ____ $^{o}$ C | breaths/min. |
|---|---|---|---|
| 5 | | 35 | |
| 10 | | 40 | |
| 15 | | 50 | |
| 20 | | 60 | |
| 25 | | 70 | |

5. Using another color pen or pencil, graph these averages on the graph in Part B.

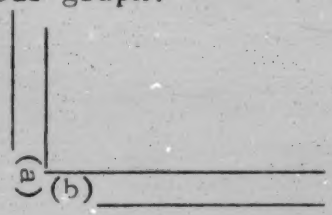
6. Give one or two reasons for any difference in values.

# GRAPHING DATA

Name _____ Section _____ Date _____ Instructor _____

A. Preparing your graph:

1. a & b.




2. _____

3, 5 & 9 - put your answer on the graph below.

4. The space between numbers on the horizontal axis is _____.

6. The vertical axis shows _____.

7. _____ breaths per minute

8. Intervals on the vertical and horizontal axis _____.

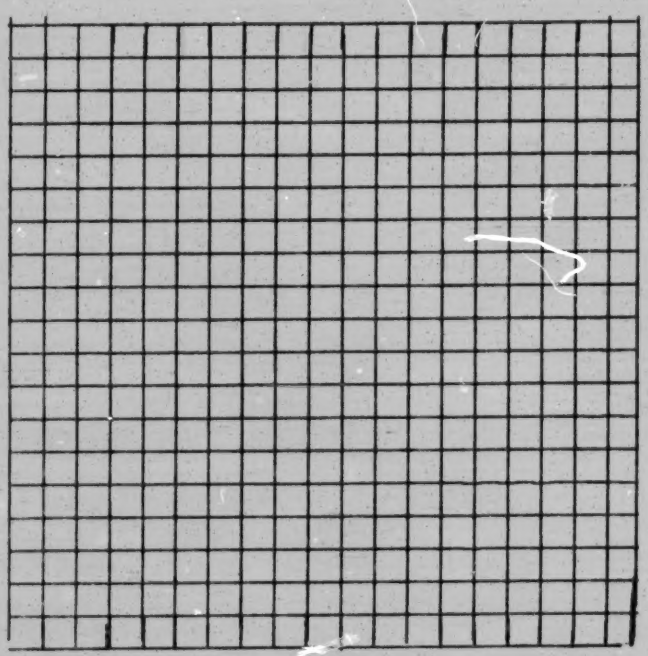
10. At 5°C the breaths per minute are _____.

11. At 15°C the breaths per minute are _____.

13. You are comparing breaths/minute with _____.

B. RECORDING DATA:

| Temp. °C | Breath/min. | Challenge |
|---|---|---|
| 5 | 6 | |
| 15 | 12 | |
| 25 | 43 | |
| 35 | 60 | |
| 40 | 67 | |
| 50 | 72 | |
| 60 | 75 | |



C. INTERPRETING GRAPHS:

15. a._____ b._____ c._____ d._____

16. a._____ b._____

17. _____

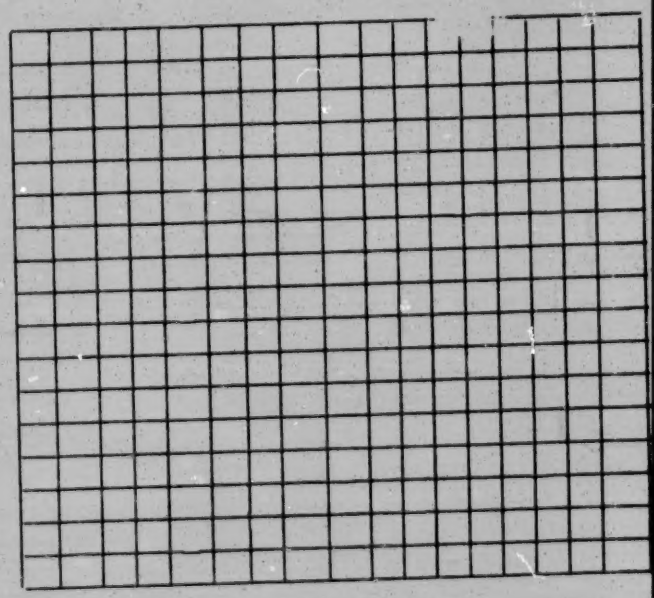
_____

PART II

IV. GRAPHING YOUR DATA

Copy the data from your frog experiment Learning Activity 1.01 on the chart below. Use the average breaths per minute.

| TRIAL | TEMP. °C | AVER. Breaths/min. |
|---|---|---|
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |



V. CONCLUSION:_____

_____

_____

_____

CHALLENGE:

MATERIAL

2._____

3._____

6._____

# MAKING SLIDES

PURPOSE: To learn how to prepare slides and to use the microscope

MATERIALS:

1. One member of the team get the following items from supply table:

   1 slide

   1 cover slip

   1 medicine dropper

   1 letter e

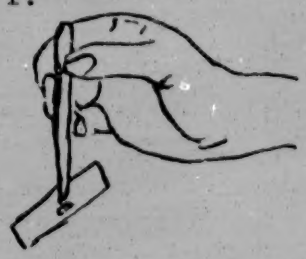
   1 baby food jar of water

2. The other member get the microscope assigned to you. You are responsible for it so handle it carefully. Report any damage immediately.

PROCEDURE:

PART 1.

1. Put the square on the slide so that the "e" is upside down. Add a drop of water with a medicine dropper, and cover with a cover slip, which is a thin square of plastic or glass. Your slide should look like the one at the right. The cover slip helps to protect the low and high power lenses, and it helps to keep the preparation from drying out.

1. 

2. Secure the slide under the stage clips on the state of the microscope. This prevents breakage of slides and improves the focusing.

   Make sure the "e" is upside down and over the hole in the stage.

2.

3. Looking from the slide, use your coarse adjustment knob to raise the stage until the lens almost touches the cover slip.

3.

4. Check to see that the gray disc is set at 100 magnification.

5. Now, look into the eyepiece (try to keep both eyes open), and with the coarse adjustment knob begin to lower the stage. Bring the "e" into sharp focus.

6. Use the fine adjustment to bring the "e" into even sharper focus.

7. Now slowly rotate the gray disc while looking at the image. Rotate the fine adjustment carefully to keep the image in sharp focus.

8. Now that you have focused the "e" on your slide in low power and high power, you are ready to answer the questions below. Use the slide you have made in answering the questions. Your teacher will give you the correct answers.

   a. To focus your microscope, you must first focus in --- power.

   b. Then, you may switch to --- power. On high power, you use only

   c. the --- adjustment to sharpen the image. On high power never

   d. use the --- adjustment.

9. Switch back to low power. Sharpen up the image of the "e".

   draw the "e" just as you
   see it in your microscope.

Ask your instructor to check your slide and drawing and to date and initial your report.

Part II. Now continue to work doing the following exercises:

1. Look at the "e" on your slide, not looking through the microscope. Then look at the "e" through the microscope. Name two things which appear different about the "e" when you look at it through the microscope:

   (a) The "e" is --- (b) The "e" is ---

2. While looking through the microscope, move the slide with the "e" to your right. Which way does the "e" appear to move in the microscope? The "e" moves to the ---.

3. While looking through the microscope, move the slide with the "e" up (or away from you). Which way does the "e" appear to move in the microscope? The "e" moves---.

4. Switch to high power again. Remember, USE ONLY THE FINE ADJUSTMENT TO SHARPEN THE IMAGE OF THE "e".

   Do you see more of the "e" or less of the "e"? ---

5. Move the slide with the "e" to the right as you did before. The "e" moves to the ---.

6. Move the slide with the "e" up, as you did before. The "e" moves---.

7. Choose one of the following materials, and make a slide:

   HAIR: Cut several strands of hair from your head. Put them on a slide. Add a drop of water, and cover with a cover slip.

   SAND: Place several fine grains on a slide. Add a drop of water and cover with a cover slip.

   CLOTH: Cut a small piece of cotton or wool cloth to put on a slide. Add a drop of water, and cover with a cover slip.

Focus first in low power, using the coarse and fine adjustments. In the space below make a drawing of what you see under the low power of your microscope.

8. Switch to high power, using ONLY THE FINE ADJUSTMENT to sharpen the image. Make a drawing of what you see in the microscope.

9. a. Wash and dry all equipment.

   b. Return the materials to the supply table CLEAN.

   c. Wrap the cord around your microscope, put the cover on and return it to the PROPER CUPBOARD.
   #26-29 first on the left
   #30-33 middle
   #35-38 first on the right

III. Concept Review - What have you learned? Place a check mark before

1._____ Given the names of the parts of the microscope, can you match them with the correct parts on the microscope?

2._____ Can you give the magnification on low and high power of the microscope?

3._____ Can you tell two ways to care for the microscope?

4._____ Can you give the steps in focusing a microscope, first on low power and then on high power.

If you can do each of these, continue on. If you think you would have problems with any of these items, go back and review, or ask your teacher for help.

ANSWERS TO QUESTIONS.

PART I

#8. a._____ c._____

b._____ d._____

#9. Draw the "e" as it looks under the microscope.

PART II

#1. a._____ 4._____

b._____ 5._____

#2. _____ 6._____

#3. _____

#8 Draw the material you used to make your special slide.

PART III

1._____ 3._____

2._____ 4._____

Ask your instructor to check your slide and drawing and to date and initial your page.

_____ _____

# ECOLOGY

Name _____ Section _____ Date _____ Instructor _____

INTRODUCTION:

Ecology is the study of the relationship of plants and animals to each other and their surroundings.

In this unit we will study some of the factors involved in these relationships.

OBJECTIVES:

At the end of this unit, you should be able to:

1. Contrast physical and biotic environments.
2. Identify and explain a food web.
3. List the organisms found in a pond community.
4. List the steps in ecological succession in a pond; and on bare rock.
5. Contrast the harmful and beneficial relationships between various organisms.
6. Given a plot of land, be able to determine the ratio of each organism by sampling technique.
7. Contrast each pair of terms:

| | | |
|---|---|---|
| 1. Abiotic Factors<br>Biotic factors | 2. prey<br>predator | 3. ecology<br>ecosystem |
| 4. carnivore<br>herbivore | 5. food chain<br>food web | 6. parasites<br>sapraphytes |
| 7. commensalism<br>mutualism | | |

NEW WORDS:

environment, population, scavengers, substratum, larvae, community, climax, lichen, algae

# E C O L O G Y

Name _____ Section _____ Date _____ Instructor _____

| NO. | TITLE | DESCRIPTION | DATE & INITIAL | COMMENTS |
|---|---|---|---|---|
| 2.01 | Physical Environment | Tape | | |
| 2.02 | Food Web | Tape | | |
| 2.03 | Pond Community | Tape | | |
| 2.04 | Ecological Succession | Tape | | |
| 2.05 | Harmful & Beneficial Relationships | Lab | | |
| 2.06 | Use & Conservation of Resources | Reading | | |
| 2.10 | Sampling | Field Study | | |
| 2.11 | Comparison of sunny vs. shady areas | Field Study | | |
| 2.12 | Ecological Succession | Field Study | | |
| | CHALLENGE MATERIAL | | | |
| 2.50 | Terrestrial & Marine Biomes | Tape | | |
| 2.51 | Forest Biomes | Tape | | |
| 2.52 | Grassland, Desert & Tundra Biomes | Tape | | |

TIME: You will have approximately four weeks to complete this unit. Do as much as you can do WELL in the time allotted. You may come into the room and use the equipment during free mods if you wish. Those who complete all the exercises may go on to the Challenge Material, but remember Quality is more important than Quantity.

GRADING:

1. Quality of work submitted
2. Attitude - responsible, independent
3. Work - careful, quiet, tidy
4. Quantity - of work completed

REMEMBER 4 ITEMS: Q.A.W.Q.

# CONDITIONS OF THE ENVIRONMENT

We are introducing the use of tapes in some units of study this year for several important reasons;

1. All students are individuals and differ in their
   a. Interests
   b. Sense of responsibility and dependability
   c. Level of maturity and self-discipline
   d. Ambition to get a good education
   e. Rate of learning

2. By using tapes and independent study each student may
   a. Do extra work on topics that interest him or her
   b. Develop his dependability and responsibility by doing the Learning activities carefully and independently
   c. Improve his maturity and self-discipline by meeting the challenges of each new Learning Activity and by working quickly, qui and neatly in the room.
   d. Proceed at his own speed depending upon his ambition and learning ability

I. Tape - Conditions of the Environment

   1. Listen to the tape very carefully. Stop the tape recorder.
   2. Now study the transparency "Environmental Factors". Look at it carefully then try to answer the questions below.

II. Match the terms with the proper definitions. You may look up the answers in your text or a research book, you may play the tape again or read the tape material on the typed sheet.
PUT YOUR ANSWERS ON YOUR REPORT SHEET.

III.

1. The study of the relationship of living things to each other and their physical environment
2. Light, temperature, humidity, water, soil
3. Green plants use light energy in
4. Many plants and animals thrive in temperatures between $0^{\circ}$ - $32^{\circ}$C or $30^{\circ}$ _____F
5. Organisms living in water
6. The amount of moisture in the air is known as
7. The term "Substratum" refers to the
8. The type of soil determines the kind of _____which can live in a region.
9. The type of plants available also determine the type of_____which can live in a given region.
10. The atmospheric gas needed by animals is

a. limiting factors
b. carbondioxide
c. soil
d. plants
e. $85^{\circ}$F.
f. oxygen
g. $50^{\circ}$C.
h. photosynthesis
i. aquatic
j. humidity
k. ecology
l. animals

IV. Fill in the missing terms in the "Concepts to Remember" on your Record Sheet.

TAPE SCRIPT PHYSICAL ENVIRONMENT L.A. 2.01

Living things interact with each other and with their physical environment. The study of these relationships is termed ECOLOGY. The word ecology is derived from two Greek words which, when put together, mean "a study of the home". When you study ecology you are learning about living organisms in their "homes" or their ENVIRONMENTS. The word environment means all the external conditions and influences affecting the life and development of an organism.

We live in a world which is made of ecological systems or ECOSYSTEMS. An ecosystem consists of groups of organisms together with their non-living environment. It is an interacting system. The living organisms in an ecosystem - plants, animals and protiens - are referred to as the BIOTIC components. The non-living portions, soil, water, air, etc. are called the ABIOTIC components. We rely on plants, both directly and indirectly. Not only are they eaten by us, but they also are food for animals. In turn the animals provide us with some of our daily food. These relationships form a FOOD WEB which you will study in the next lesson. The physical or abiotic factors determine the quantity and the quality of plants and animals available, thus controlling our existence.

The chief abiotic components affecting the distribution and success of living things are light, temperature, wind, water, substratum or soil and atmospheric gases. These environmental factors are also referred to as limiting factors, because of their direct relationship to the biological existence of the organism. These factors do not operate independently of each other.

Light - Light energy is necessary for green plants to carry on photosynthesis. All animals are directly or indirectly dependent upon the food substances produced by green plants. The intensity, duration, and wave length (color) of light are important factors which regulate the life activities of many living things.

Temperature - Many living things carry on their life activities at temperatures between $30^{\circ}F$ and $85^{\circ}F$. Some organisms are able to exist at much higher temperatures; others are able to live at much lower temperatures The daily and seasonal temperature changes often act as limiting factors and determine the number and kind of organisms present in a region.

Wind - Wind affects the growth and development of plants. First it is often the determining factor in controlling the amount of rainfall a given area receives especially in mountainous regions where the windward side receives much more rain than the leeward side. The force of winds also determines which types of plants can survive in an area.

Humidity and Water - Moisture in the air is very necessary for many plants and animals to function properly. Some animals are active only at night when the humidity is higher. Aquatic habitats are subject to changes in chemical and gas content and to fluctuation of depth. Waterholes in the Everglades of Florida and savannas of Africa are all important for the existence of the native wildlife.

Substratum - This is defined as the base or material on which an organism lives. The type of soil, for example, is a limiting factor for the vegetation, which, in turn, may be a determinant of the animal life capable of living in the habitat.

Atmospheric gases - Oxygen and carbon dioxide are generally not limiting factors for terrestrial organisms. These two gases are abundant in our atmosphere. These gases can be limiting factors for aquatic organisms.

The major concepts you should learn from this lesson are:

1. Ecology is a study of the relationship of biotic or living things to each other and to their abiotic or non-living environment.

2. The physical environment affects the kind,quantity and quality of plants and animals in a given region.

3. The absolute necessity for man to stop polluting the air, water, soil etc. so the natural ecosystems can be maintained. Without them man cannot survive.

Now read the rest of the directions on your Learning Activity Sheet and follow them carefully. If you feel you need to replay the tape you may do so, but remember other students are waiting to use it also. Be considerate of their needs.

Try to answer as many of the questions as possible without any help. Then look up the answers to the questions you do not know. You can find them on the transparency or in the guide booklet, which contains the same material that is on this tape.

When you have finished your work and had it corrected by the student leader, bring your Report Sheet and the folder you were using to me. It is YOUR RESPONSIBILITY to see that all of the materials are complete and in good condition in the folder, before I date and initial your work.

# THE FOOD WEB

I. Tape - Food Web
1. Listen very carefully to the tape. Stop the tape recorder.
2. Study the transparency very carefully. Be sure you can tell organisms are:
   a. the producers.
   b. the first order consumers.
   c. the second and third order consumers.
   d. the reducers.
   e. the greatest cause of unbalancing nature.

II. Complete the following sentences. Use the terms given below.

carnivores producers herbivores reducers

1. Green plants are known as --- because they make their own food.
2. Animals which feed on plants are known as ---.
3. Animals which eat other animals are called ---.
4. Bacteria and molds break down dead and decaying plants and animals into simple compounds so they are known as ---.

III. From your study of the transparency and tape, see if you can fill in the food web on your Report Sheet.

a. Use the terms given below:

frog grass hawk insect mice rabbits snake vegetable

b. The arrows point to the prey.

IV. USING NEW WORDS: Match the terms on the right with the statements on the left. Write your answers using LETTERS on your Report Sheet.

1. Plant-eating animals
2. Organisms which make food
3. When the snake eats the frog, the frog is
4. When the frog eats the dragon fly, the frog is then a
5. Animals which eat other animals
6. Organisms which live on other living organisms and harm them
7. Organisms which live on dead organic matter
8. Wheat plant --- rabbit --- coyote

a. prey
b. food web
c. parasites
d. green plants
e. food chain
f. saprophytes
g. herbivores
h. non-green plants
i. predator
j. carnivores

REMEMBER: Your grade depends upon:
1. The quality of the work you produce including: Organization of material, accuracy of answers, neatness of report sheet.
2. Your ability to follow directions and work independently.
3. Your ability to obtain and return materials carefully & work quietly.
4. The quantity of material you cover.

In the previous lesson you learned that ecology is the study of the relationships of biotic and abiotic things. You also studied the role of the chief abiotic or physical factors in an ecosystem.

Today you will learn more about the role of the biotic factors.

The most important thing about an ecosystem is that all members are closely interdependent. Now you can see the importance of each individual's role. An ecological role is called a NICHE. Each niche is occupied by a different type of plant or animal. For example, it is the role of the green plant to produce food for itself and, in turn, for some animals. So in a natural community a green plant occupies the niche of PRODUCER. Different kinds of plants occupy the niche of producer in different ecosystems. The life in a lake or pond may be controlled by a species of algae, while beech trees may occupy the Producer niche in a forest.

Producers are the first and the most important link in the ecosystem. They provide the food for all the organisms which occupy the niche of CONSUMERS. There are two major types of consumers; HERBIVORES, those consumers which feed on green plants, and CARNIVORES, those which feed on animals.

The life forms in an ecosystem are all linked together in a FOOD CHAIN. All food chains follow a general pattern:

Producers - green plants.
Consumers - Herbivores - consumers which eat plants ie. grasshoppers, rabbits, deer, cattle.
First-order Carnivores - eat herbivores ie. frogs, preying mantids, rodents, birds.
Second-order Carnivores - eat 1st order carnivores, snakes, large birds, weasel.
Third-order Carnivores - eat 2nd order foxes, coyote, wolves.
Reducers - molds and bacteria which decompose both producers and consumers and return the materials to the soil which will be used again by green plants.

Within one ecosystem there may be one hundred or more food chains. When food chains are interwoven and interlocked with other food chains they are referred to as a FOOD WEB. Now look at the transparency and trace the path from producer to consumer to reducers.

The Food Web begins with green plants, the producers. They produce nectar which appeals to the butterfly. In a chain of events, the dragonfly feeds on the butterfly and on other flying insects. The toad feeds on the dragonfly and other insects. The toad as well as the dragonfly may be called a consumer. The snake, a consumer, preys upon the frog.

TAPE SCRIPT L.A. 2.02

FOOD WEB

The organism being sought out and eaten is the Prey. The one doing the eating is the Predator. In the frog-snake relationship the frog is the prey and the snake is the predator. Another consumer, the hawk, preys upon the snakes as well as small mammals. In the hawk-snake relationship the snake is now the prey and the hawk is the predator. When the hawk dies, his remains are acted upon by the bacteria and molds, the reducers. These reducers change the remains into soil nutrients which green plants (producers) need to grow. This completes a simplified food chain or cycle. Most chains or cycles are complex patterns with a great deal of interlocking between producers, consumers, and reducers.

The major concepts you should learn from this lesson are:

1. Plants and animals living in the same ecosystem must compete for space, food and protection from enemies.

2. Food chains follow a general pattern of Producer - herbivores - carnivores - reducers.

3. Many interwoven food chains make up a food web.

4. If man destroys one step in a food chain by using insecticides or polluting streams he upsets an entire ecosystem.

Now read the rest of the directions on your Learning Activity Sheet and follow them carefully. If you feel you need to replay the tape you may do so, but remember other students are waiting to use it also. Be considerate of their needs.

Try to answer as many of the questions as possible without any help. Then look up the answers to the questions you do not know. You can find them on the transparency or in the guide booklet, which contains the same material that is on this tape.

When you have finished your work and had it corrected by the student leader, bring your Report Sheet and the folder you were using to me. It is your RESPONSIBILITY to see that all of the materials are complete and in good condition in the folder, before I date and initial your work.

Name _____ Section _____ Date _____ Instructor _____

II. Completion Exercise:

1. Green plants are _____

2. Animals which feed on plants are _____.

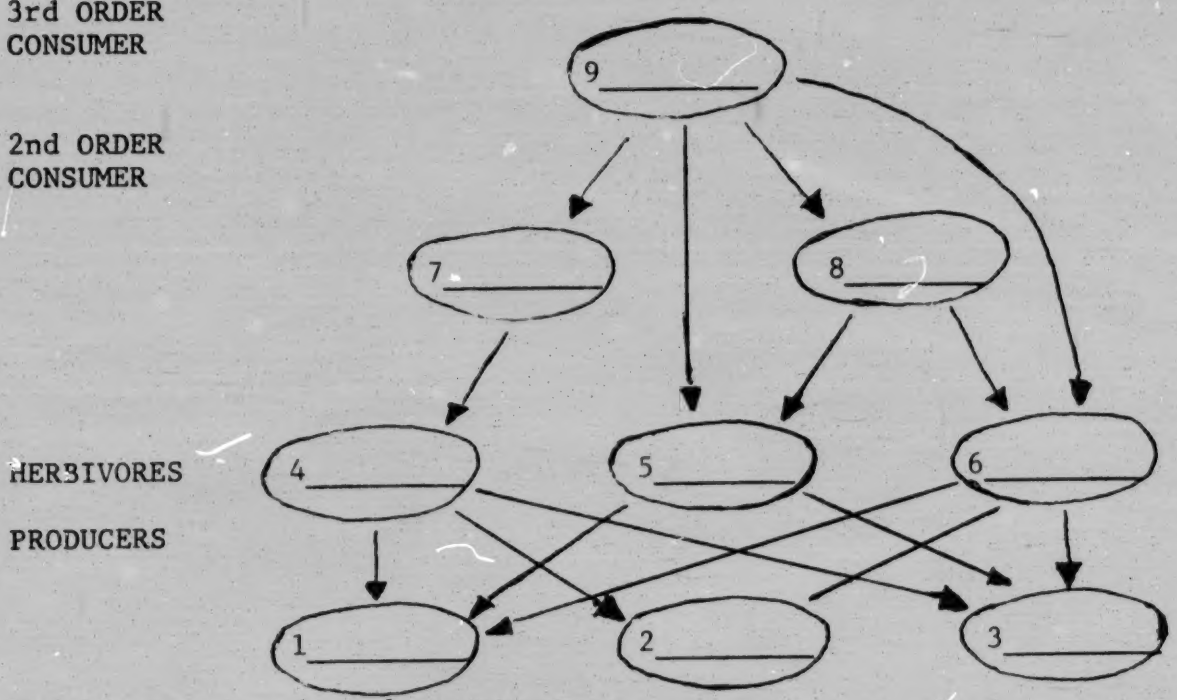
3. Animals which eat other animals are _____

4. Organisms which decay dead plants and animals are called

_____

III. Food Web

Fill in the answers with the appropriate organism:




IV. Matching new words and statements:

1. _____ 3. _____ 5. _____ 7. _____

2. _____ 4. _____ 6. _____ 8. _____

V. CONCEPTS TO REMEMBER:

Complete the sentences below. Use one of the following terms:

animal environment food web compete food protection

1. A plant or _____ living in the same _____ with others of its kind and other species must _____ for space _____ and _____ from enemies.

2. The _____ is an on-going process.

Ask the Student Leader to correct your work, correct the errors, then ask your instructor to check and initial the L.A.

_____ _____ _____

Student Leader Date Instructor

# HARMFUL & BENEFICIAL RELATIONSHIPS

## INTRODUCTION:

Organisms within a community affect each other in many different ways. Some organisms are helpful to those nearby while others are harmful. However, the overall relationships within a community are generally beneficial or the community would not survive.

There are many types of relationships. Your Text lists some types of harmful relationships and some beneficial or helpful ones.

Read your Text Pp. 18-27. Do EITHER Part 1 or 2 excerises below and do both #3 and #4.

## PART I. Competition

PURPOSE: To demonstrate the effects of competition of organisms for space, light, food and water.

MATERIALS: 32 Radish seeds, 2 small plastic containers and soil

PROCEDURE:

1. Fill two similar containers with soil.
2. Mark the containers A & B.
3. Using your index finger (first) make one hole in the soil in container A.
4. Pour 16 seeds into the one hole and cover them.
5. Now make 8 holes in the soil in container B. Spread them as far apart as possible.
6. Place two seeds in each hole and cover them.
7. Give both containers the same amount of water and light.
8. Observe them for ten days.

DATA:

| ITEM | A | B |
|---|---|---|
| Number of seeds sprouting | | |
| Appearance after 4 days | | |
| 6 days | | |
| 8 days | | |
| 10 days | | |

DISCUSSION:

1. Which container had the healthier plants?
2. Explain why one container differed from the other.
3. Using your results, explain why the tree pictured on Page 19 grew more in 1937 than in the six previous years.
4. Explain why one bluegill sunfish is so much larger than the other.

PART 2 - SAMPLES OF HARMFUL & BENEFICIAL RELATIONSHIPS

PURPOSE: To demonstrate some harmful and some beneficial relationships of one organism with another.

MATERIALS:

Samples of parasites, saprophytes, etc. Use your Test, Pp. 20-21 and 24-25 for ideas. One large sheet of cardboard, small pieces of paper, magic marker, glue or paste

PROCEDURE & DATA:

1. Collect whatever samples you can find.
2. Identify the relationship illustrated.
3. LETTER the relationship and a brief description on small pieces of paper.
4. Arrange the samples and descriptions carefully and paste them on the cardboard.
5. LETTER the title (above) across the top of the cardboard. LETTER your name, Section and Date in the lower right hand corner.

PART 3 Identify the following relationships as harmful (H) or Beneficial(B).

1. Parasites
2. saprophytes
3. lichens
4. commensalism
5. mutualism
6. grazers
7. scavengers
8. predators
9. competition

PART 4 - Match the following definitions and terms:

1. Organisms living on other living things harming them.
2. Two organisms living together each helping the other.
3. Two organisms living together one of which is helped, the other not hurt.
4. Organisms living on dead organic material.
5. Animals which eat dead organisms.
6. Animals which kill other animals for food.
7. Animals which are killed by others.
8. Animals which feed on plants.
9. Animals which feed on other animals.
10. The combination of an algae and fungi living together.

a. commensalism
b. herbivores
c. saprophytes
d. predators
e. competition
f. parasites
g. lichen
h. mutualism
i. carnivores
j. prey
k. scavengers

# USE AND CONSERVATION OF RESOURCES

## INTRODUCTION:

When Europeans first came to America, they found a land of amazing richness. There were fine forests of hardwood and evergreen trees. The rivers, streams and lakes were clear and well stocked with fish. There was rich topsoil, excellent for raising crops. Enormous mineral deposits lay beneath the surface of the earth.

Early settlers and later industrialists exploited these resources with no thought of the future.

In the early part of the twentieth century, foresighted men realized that our natural resources would soon be completely exhausted if the waste and destruction was not stopped. Campaigns and laws to care for our resources were started but too few people listened. Today we are faced with many problems resulting from this lack of care. Your Text discusses a few of them. Read the text, Pp. 60-76. Answer Part I or Part II or Part III using the outline below as a guide. You may change it if you wish to. Then answer the Parts 4, 5 and 6, summarizing the Chapter. Write your answers on your Report Sheet.

## PART I.

1. Importance of Forests:
   - a. Location of major U.S. Forest regions and users of them
   - b. Methods of cutting trees
     1. Compare good and bad methods.
     2. Give results of each.
   - c. List some valuable forest products.

2. Forest fires
   - a. major causes
   - b. methods of fighting

3. Conservation
   - a. Methods of conservation
   - b. The contribution you can make

4. Suggestions:
   - a. Make a booklet containing pictures, pamphlets and a written report.
   - b. Make 2 posters.
     - (a) Contrast methods of cutting and results
     - (b) Contrast burned out area and conservation area.
   - c. Three-dimensional project illustrating 1, 2 or 3 in the outline.
   - d. Make a poster using samples of various types of wood

and write a brief account of each. e.g. Name, where found, common uses.

e. Give a 10 minute illustrated talk on Forests.

---

PART II. WATER

1. Importance of water
   a. major sources of supply
   b. 4 major uses - describe each briefly

2. Water Purification
   a. Brief description of 1 or 2 methods
   b. Locate New Castle County purification plant.
   c. Methods of reusing water

3. Water Pollution
   a. 3 major causes
   b. Methods being used to remedy problem
   c. What can YOU do to help?

4. Suggestions:
   a. Make a booklet containing pictures and a written report.
   b. Make two posters - 1 describing water purification and 1 describing water pollution.
   c. Make a three-dimensional project illustrating a hydroelectric plant and write a brief report on it.
   d. Give a 10 minute illustrated talk on water pollution in New Castle County giving practical solutions to the problem.
   e. Make a survey of the aquatic life in a clean stream and a polluted stream.

---

PART III SOIL

1. Importance of soil
   a. Define top soil and humus.
   b. Formation of top soil.

2. Soil erosion
   a. Types of erosion
   b. Methods of prevention

3. Department of Agriculture
   a. Soil analysis & Crop information
   b. Land classification
   c. Soil minerals and crop rotation

4. Suggestions:
   a. Make a collection of pamphlets from U. S. Department of Agriculture and/or University of Delaware on soil.
   b. Make a three-dimensional project illustrating several types of erosion on one side and the remedy on the other.
   c. Set up two trays as seen in your Text P. 68. "Conserving Soil". Read and follow the directions. Record your data and answer the questions.
   d. Make a booklet containing pictures and a written report.
   e. Make a diagram of the school property and show where erosion is occurring and suggest a remedy.
   f. Do the Erosion Problem, Page 67 of your Text.

PART IV.

Complete the following sentences by adding one of the following terms:

Renewable Artesian divide economic conversation
Nonrenewable aquifiers watershed aesthetic

1. Coal, oil and natural gas are known as --- resources because they can not be used without destroying them.

2. Porous rocks which hold water are known as --- .

3. The total region drained by a stream is called the --- of that stream.

4. The pleasure people get from beautiful surroundings is known as --- value.

5. Before --- can be successful, all Government and private agencies must agree to cooperate with each other.

PART V.

Study the picture on Page 77 of your Text. Identify the problems indicated by the following numbers:

1. 2 and 5, 9,10, and 11. 14.

PART VI.

Match the following statements and terms. Answer in LETTERS

1. Loss of top soil by water or wind — a. seedlings
2. Planting crops in different fields to conserve minerals. — b. reversible
3. Planting crops around hills. — c. contour plowing

4. Grazing in forest lands destroys
5. Cutting down all the treas in a forest
6. Planting new trees where others are cut
7. Cause great damage to forests
8. Marsh lands are valuable as breeding places for
9. Building roads and filling in marshes are examples of --- changes
10. Planting trees or shrubs along fences prevents erosion by

d. reforestation
e. erosion
f. ducks
g. selective cutting
h. rotating
i. wind
j. insects
k. clear cutting
l. irreversible

FIELD STUDIES - #1 SAMPLING

PURPOSE: To estimate the percentage of each kind of plant and/or animal found in a large area.

MATERIALS:

1. Wire coat hanger bent into a hoop shape with a 6 inch piece of adhesive or rag tied to it for easy location.
2. Chart to record your numbers (data).
3. Optional: Pictures or Field Guide to help in identification.

PROCEDURE:

1. Toss the wire hoop anywhere in the field.
2. Identify the different kinds of weeds found in the area entirely inside the hoop. Use your Text, Page 9 or one of the Field Guides in the classroom.
   a. If you do not know the names of the plants, place one leaf of each plant in a separate sandwich bag and label them Sample A, B, C, etc.
   b. Now count the number of whole plants (not leaves) like Sample A and record it on your Chart under Sample #1.
   c. Count the number of plants like Sample B and record it. Continue until you have counted each type of plant within the hoop. Record all of these numbers under Sample #1.
3. Toss the wire hoop in another area and repeat step a. in #2 above. If you find a different type of plant, place one leaf in a sandwich bag as before and label it the next letter of the alphabet. Then repeat steps b. and c. above in #2. Place these numbers under sample #2 of your chart.
4. Repeat this procedure until you have ten samples and 10 columns of numbers.
5. Make your counts carefully and honestly. Do not be disturbed if some samples have none of one species.
6. Now calculate the total number of each species in the 10 samples taken. Record it in the column on the right of your chart.
7. Add the right hand column to obtain the total number of plants. To calculate the percentage, divide the number of one species by the total number of plants. e.g.

| | |
|---|---|
| Dandelion | 38 |
| Crab Grass | 53 |
| Total Plants | 475 |

$$475\overline{)53{,}000} = 11.2\%$$

475
550
475
750
475
2750
2375
375

$$475\overline{)38.00} = .08 = 8\%$$

3800

DISCUSSION: Answer the following questions on your Report Sheet.

1. Were you able to identify all of your samples?

2. Where did you look for your answers?

   a. --- --- ---
   (Title) (Author) (Publisher)

   b. --- --- ---

3. What do we call this method of studying a field? ---

4. Why did we use this method? ----------

5. Compare your percentages with those of three other groups of students.
   a. Which are about the same, i.e. - or + 5? ---
   b. Which are very different? -----

6. Can you explain the similarities and/or differences found in #5 answer? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

REMEMBER: Your grade depends upon:
1. Your ability to follow directions and work independently.
2. Your ability to obtain and return materials carefully and quietly.
3. The quantity of material covered.
4. The quality of the work you produce including:
   a. Organization of materials
   b. Accuracy of your answers
   c. Neatness of the Report Sheet

Name _____ Section _____ Date _____ Instructor _____

I. Chart showing the number and kind of plant in each sample of the sunny and shady areas

| | SUNNY AREA | | | | | | | SHADY AREA | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SPECIES | 1 | 2 | 3 | 4 | 5 | TOTAL | % | 1 | 2 | 3 | 4 | 5 | TOTAL | % |
| | | | | | | | | | | | | | | |
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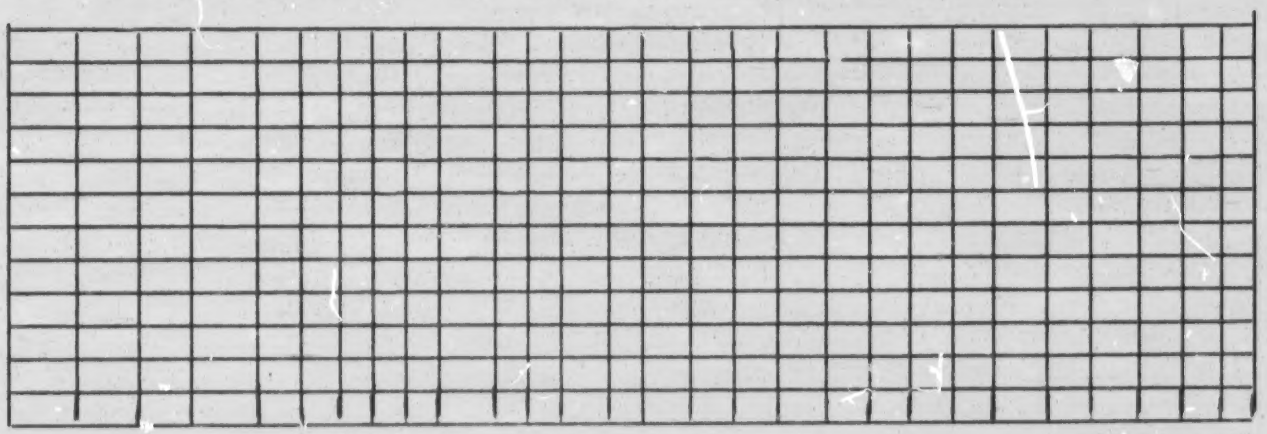
II. Make a histogram of your results. Use red for the sunny area and blue for the shady. (skip 1 square between each bar)



PERCENTAGE OF SAMPLES

III. DISCUSSION:

1. The species found only in the sun are:

   A._____ B._____ C._____

2. The species found only in the shade are:

   A._____ B._____ C._____

3. The species that were present in both areas are:

   A._____ B._____ C._____

4. Two factors other than the sun which might affect growth patterns are:

   1._____ 2._____

GENERAL BIOLOGY
FIELD STUDIES #2

LEARNING ACTIVITY 2.11

# COMPARISON SUNNY VS. SHADY AREA

**PURPOSE:** To determine how the presence of sunlight affects the population of a given area.

**MATERIALS:**

1. Wire coat hanger used in L.A. #2.10
2. Chart to record data

**PROCEDURE:**

1. Toss the wire hoop anywhere in the sunny area.
2. Identify, count and record the number of each species found entirely within the hoop.
3. Make five counts and record the results on your table. Get the totals.
4. Toss the wire hoop anywhere in the shady area.
5. Identify, count and record the results as in Step #2 and #3 above.

**DISCUSSION:**

1. What species were found only in the sunny area?
2. What species were present only in the shady area?
3. What species grows well in both areas?
4. Suggest two factors, other than the sun, which could affect the growth patterns.

- - - - - - - - - - - - - - - - - -

**REMEMBER:** Your grade depends upon:

1. Your ability to follow directions and work independently.
2. Your ability to obtain and return material carefully and quietly.
3. The quantity of material covered.
4. The quality of the work produced including:
   a. Organization of materials
   b. Accuracy of your answers
   c. Neatness of the Report Sheet

# TERRESTRIAL & MARINE BIOMES
(Optional Material)

I. Listen carefully to the two topics discussed on the tape.

II. Study the location of the various biomes and then answer the questions below.
Write the answers on your Report Sheet. PLEASE DO NOT PUT ANY MARKS ON THIS PAGE.

III. Complete the following sentences by filling in an appropriate word.
1. Most of South America is covered with (a)--- forests. This is possible because the region is (b)--- and has 75 or more inches of (c)--- each year.
2. Northern (d)---, the (e)--- Peninsula and most of (f)--- Australia are (g)--- because of a lack of rainfall.
3. Deciduous forests are found chiefly in the Eastern part of (h)--- and in (i)---.
4. Much of Canada, the Scandinavian Peninsula and Siberia are covered with (j)---.
5. The Tundra regions are located in Northern (k)---, (l)--- and the Island of (m)---.

IV. Match the following terms and definitions. Use LETTERS for your answers. DO NOT PUT ANY MARKS ON THIS SHEET, PLEASE.

1. Desert in Asia
2. Grasslands in Africa
3. Grasslands in Eurasia
4. Forests composed of evergreen trees
5. Forests in which the trees lose their leaves.
6. The study of the interaction of plants and animals with the climate and soil
7. A large ecological unit which is able to maintain itself

A. ecology
B. deciduous
C. realm
D. savanna
E. biome
F. Gobi
G. steppes
H. coniferous

V. Complete the following statements. Write answers on your Report Sheet. PLEASE DO NOT PUT ANY MARKS ON THIS SHEET.
1. Three-fourths of the earth's surface is covered by (a)---. The water contains many minerals especially (b)---.
2. The temperature of the surface water varies from (c)---$^{o}$F to (d)---$^{o}$F The deep water remains at (e)---$^{o}$F.
3. The neritic zone is the shallow water above the (f)--- shelf. Barnacles, crabs and (g)---, (h)--- and (i)--- are found there.
4. The benthic zone is found at the (j)--- of the sea. (k)---, (l)---, (m)--- are found there.
5. The open sea is called the (n)---zone. Porpoises (o)---, (p)--- and many species of bony (q)--- are found in this zone.
6. The basic producer of food chains is microscopic plants known as (r)-- Zooplankton such as (s)---copopods and small (t)--- are part of the food chain.

# TERRESTRIAL & MARINE BIOMES

A climax community may occupy a relatively small geographic region. However, this is not always the case. A BIOME is a climax community of plant and animal life that is typical of a broad region with one kind of climate. Not all the sites within this region need be of the climax type, but local climatic conditions permitting, there is a general uniformity of dominant plant species within the region. The climate of a region depends upon the temperature, precipitation, that is rainfall or snowfall, sunlight and winds. Nearness to mountains and large bodies also effects the climate of a region.

The six major realms of the world are the Nearctic, Palearctic, Neotropical, Ethiopian, Oriental, and Australian. Locate these on the transparency. These realms have no definite or clear-cut boundaries even though the names may suggest some. Within each realm one or more terrestrial biomes may be found. A terrestrial biome is a large, ecological unit which is able to maintain itself. It is the result of interaction of plants and animals with the climate and substrata (soil) of the region. Major terrestrial biomes include the tropical rainforests, coniferous forests, deciduous forests, grasslands, deserts, and tundra. The tundra biome extends across the northern part of North America and Eurasia. The desert biome is found throughout the world---Africa (Sahara). Australia, North America and in Asia, the large cold Gobi Desert. The grassland biomes cover large areas of the world. They are known by different names on the various continents. They are prairies in North America, Savannas in Africa, Pampas in South America, Steppes in Eurasia. Australia also has large areas of grassland. Deciduous forest biomes are found in the eastern part of North America, in Europe, Japan, and Australia. Coniferous forest biomes stretch across North America (from California to Alaska, eastward to the Atlantic Ocean) and across Eurasia. The tropical rainforest biome can be found in South America, Central America, central Africa and Southeast Asia (mainland and islands). Most of North America is located in the Nearctic Realm. This realm can be divided into the Californian, Rocky Mountain, Alleghenian and Canadian zones. Each zone has one or more biome within it. The coniferous forest is a chief biome of the California zone. Within the Rocky Mountain zone there are deciduous forest, coniferous forest, grassland, and desert biomes. The Alleghenian zone contains deciduous forest and grassland biomes. Within the Canadian zone there are the coniferous forest and tundra biomes. Each world realm can be divided into zones which in turn contain characteristic biomes.

## The Marine Biome

The two-thirds of the earth's surface covered by oceans contains more plants and animals than are found on land. Probably 90 per cent of the food-making and oxygen-releasing on this planet occurs in the waters. Most life on our planet occurs in fresh or salt water.

The main physical factors affecting the growth of aquatic organisms are the quantity of available oxygen and carbon dioxide, the temperature, the presence of dissolved or suspended materials, and the intensity of light.

Variations in temperature are not as great in aquatic areas as on land. The surface waters range from 32° F in the arctic seas to 85°F in the tropic zone. At great depths the water remains a constant 31°F. The aquatic areas are thus the largest and most stable ecosystems on earth.

The oceans of the world constitute a huge continuous body of water. Some characteristics of this world ocean are:

1. It absorbs and holds large quantities of solar heat and moderates the earth's temperature.
2. It contains a relatively constant supply of nutritive materials and dissolved salts especially sodium chloride.
3. It is the most populated of all the habitats on this planet.

Environmental conditions in the oceans are far more uniform than on land, but even within the marine biome distinct zones occur.

The littoral zone is the region of the continental shelf. It may extend several hundred miles from shore until it drops to a depth of about 600 feet. This is the depth to which some light penetrates.

The littoral zone along the coast is the most productive region of the oceans. Life in this region is affected by the presence of organic and inorganic materials brought down by the rivers. In these shallow waters, there may be a luxuriant growth of brown algae such as the kelps.

The pelagic zone is the region of the open sea where plankton is the basic food. Plankton consists of the drifting minute plants and animals on or near the surface of bodies of water. The main members of the plant plankton (phytoplankton) of the sea are diatoms, other kinds of microscopic algae, and dinoflagellates. The phytoplankton is the basic producer of ocean food chains.

The animal plankton (zooplankton) includes protozoa, copepods, small shrimp, and the larval forms of many animals. The copepods feed on algae, and the copepods in turn serve as the main food of the huge whalebone whale. From algæ to copepod to whale is a short food chain. Other food chains include many kinds of carnivorous fish (e.g.,sharks)and squid.

Biologists formerly believed that the tremendous pressure exerted by the water upon the ocean bottom prevented the existence of life there. However, recently many organisms have been found on the cold, dark ocean bottom. These are mainly scavengers that depend for food upon the rain of dead organisms from above. Bacteria are present in a fine ooze which is composed mainly of the skeletons of radiolarian protozoa.

Major Concepts you should learn from this lesson are:

1. Ecologists divide the earth into six major terrestrial regions or realms.

2. One or many biomes may be found within each realm.

3. The marine biome is divided into shallow water and deep water habitats.

4. The organisms of marine waters live in the littoral zone above the continental shelf, in the open seas and on the ocean floor.

Now read the rest of the directions on your Learning Activity Sheet and follow them carefully. If you feel you need to replay the tape you may do so, but remember other students are waiting to use it also. Be considerate of their needs.

Try to answer as many of the questions as possible without any help. Then look up the answers to the questions you do not know. You can find them on the transparency or in the guide booklet, which contains the same material that is on this tape.

When you have finished your work and had it corrected by the student leader, bring your Report Sheet and the folder you were using to me. It is YOUR RESPONSIBILITY to see that all of the materials are complete, and in good condition in the folder, before I date and initial your work.

GENERAL BIOLOGY REPORT SHEET L.A. 2.50

# TERRESTRIAL AND MARINE BIOMES

I. Listen carefully to the tape. Answer the questions in parts II - V. Write the answers on this sheet. Please DO NOT WRITE ON THE BOOKLET COPY.

II. Completion Exercise (#III)

1. a._____
   b._____
   c._____
2. d._____
   e._____
   f._____
   g._____
3. h._____
   i._____
4. j._____
   k._____
   l._____
   m._____

III. Matching Exercise - Answer with LETTERS (#IV).

1._____ 3._____ 5._____ 7._____

2._____ 4._____ 6._____

IV. Completion Exercise (#V)

1. a._____
   b._____
2. c._____
   d._____
   e._____
3. f._____
   g._____
   h._____
   i._____
4. j._____
   k._____
   l._____
   m._____
   n._____
   o._____
   p._____
   q._____
   r._____
6. s._____
   t._____

# DIGESTIVE & EXCRETORY SYSTEMS

Name _____ Section _____ Date _____ Instructor _____

I. Objectives
At the end of this unit, students should be able to:

1. List the structures which make up the alimentary canal.
2. Describe briefly the function of each including the enzymes produced and the nutrient digested.
3. Locate and give the function of the salivary glands, liver, gall bladder and pancreas.
4. Define the required new words.

CHALLENGE MATERIAL (Optional)

5. Identify the structures which make up the excretory system.
6. Describe briefly the function of each.
7. Explain the functions of the kidneys in maintaining the stability of the internal environment.
8. Define the New Words in the Challenge column.

II. New Words for the digestive and excretory systems

Most of these words are new to you. Take special note of them as you come across them. You must be able to identify them in a matching or multiple choice exercise.

REQUIRED NEW WORDS:

| | | | |
|---|---|---|---|
| appendix | epithelial tissue | peristalsis | |
| ducts | esophagus | pancreas | |
| duodenum | large intestines | liver | |
| epiglottis | salivary glands | pH | |
| lacteal | small intestines | pharynx | |
| larynx | smooth muscles | rectum | |
| villi | stomach | | |

CHALLENGE:

Bladder
Bowman's capsule
Glomerulus
Kidney
Ureter
Urethra

# DIGESTIVE AND EXCRETORY STUDIES

Name _____ Section _____ Date _____ Instructor _____

| NUMBER | TITLE | DESCRIPTION | CHECK | COMMENTS |
|---|---|---|---|---|
| 8.01 | The Digestive System | Tape | | |
| 8.02 | The Digestion of Nutrients | Lab | | |
| 8.03 | The Digestion of Proteins in Food | Lab | | |
| 8.04 | Rev. 8.01, 8.02 and 8.03 | Quiz | | |
| 8.05 | pH and Digestion | Lab | | |
| 8.06 | The Digestive System | Microviewer #67 | | |
| 8.07 | Rev. Digestive System | Reading | | |
| 8.08 | Enzyme Activity | Lab | | |
| 8.09 | Protein Building (DNA Models) | Lab | | |
| 8.10 | Test on Digestive Challenge Material | | | |
| 8.50 | The Excretory System | Tape | | |
| 8.51 | Excretion | Microviewer #52 | | |
| 8.52 | Rev. Excretory System | Reading | | |
| 8.53 | Rev. 8.50, 8.51, 8.52 | Quiz | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| STUDENT SELF-EVALUATION | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

# THE DIGESTIVE SYSTEM

I. Listen carefully to the tape.

II. Study the diagram of the digestive tract in your text book on Page 220. Also, study the table on Page 221. You will be expected to know the two columns headed Material digested and Products. When you think you know the material, do the Matching Exercise and the Completion Material. Do as much as you can without any help first. Then look up the answers to the questions you do not know.

III. Study the flash cards.

IV. Matching the statements and terms:

| | |
|---|---|
| 1. Lubricates food in the mouth | a. glycerol |
| 2. One end product of fat digestion | b. pyloric |
| 3. The final sugar in starch digestion | c. saliva |
| 4. Wavelike series of contractions which move food along. | d. pancreas |
| | e. bile |
| 5. The valve between the stomach and small intestines. | f. glucose |
| 6. End product of protein digestion | g. hormones |
| 7. Substance which emulsifies fat. | h. amino acids |
| 8. The organic catalysts which hasten the breakdown of foods. | i. perista sis |
| | j. small intestines |
| 9. Digested nutrients are absorbed into the--- in the ---. | k. enzymes |
| 10. The organ which stores glycogen and breaks down excess amino acids. | l. villi |
| | m. liver |

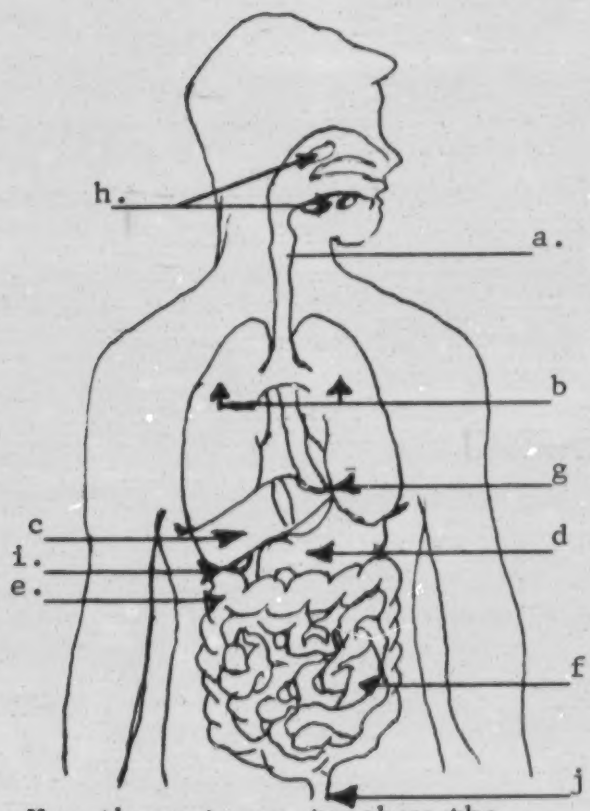
V. Complete the material on the next page after you think you know the diagrams, flash cards and table on Page 221.

PLEASE DO NOT PUT ANY MARKS ON THIS SHEET.

Write all answers on your Report Sheet.

_____

# WHAT DOES YOUR BODY NEED?




I. Use these terms to show the structures indicated by each letter on the diagram.

salivary glands
esophagus
liver
stomach
large intestines
small intestines
rectum or anus
lungs
diaphragm
gall bladder

II. Use these terms to fill in the blanks at the right. You may use them more than once.

4. Trace the path of food that we eat, going from the mouth to _____

5. Food is mixed with digestive juices in the _____

6. More juices are mixed with the food in the _____

7. The food is absorbed and carried to all parts of the body by the _____

8. Unused food is pushed out of the body by the muscles of the _____

9. Waste materials from the blood and other liquid wastes are carried off by the _____

10. We breathe air into our _____. This air is called _____

11. We breathe out a harmful gas called _____

12. Besides food and air, our bodies must have _____

13. How does the body get water?

14. How and when does the body get rest?

In order for each of the cells of the body to receive and to use the nutrient materials taken into the body digestion must occur. Digestion is the process by which the large complex molecules of foods are broken down into simple substances which can be absorbed through cell membranes.

The smell of tasty food may trigger the digestive system into action. Salivary and digestive glands may begin to secret their products before food is present. The process of digestion begins in the mouth. The teeth hold, tear or chew the food. The tongue moves the small pieces around allowing the food to be thoroughly mixed with saliva. There are three pairs of salivary glands, the paratid, maxillary and the sublingual. Their secretions not only moisten the food to aid in swallowing, but also add an enzyme which begins the conversion of starches to sugar. The tongue moves the food mass to the rear of the mouth where the food is swallowed. A muscular tube, the esophagus, about ten to twelve inches long and one inch in diameter, receives the food mass and moves it along to the stomach. This is accomplished by a wave of muscular contractions (Peristalsis) which forces the food downward. The cardiac valve controls the entrance of food into the stomach. The stomach is a muscular sac lined with a mucous membrane. It receives the food and adds gastric juices. These are enzymes known as pepsin, renin and gastric lipase. It also produces hydrochloric acid. As food is churned in the stomach, chemical reactions take place which reduce the more complex proteins into simpler substances called peptides.

The pyloric valve controls the release of the partially digested food material into the small intestine. This organ is twenty to thirty feet in length and about one inch in diameter. It has three main divisions, the duodenum, jejunum and the ileum.

The digestive processes that occur in the small intestines are dependent upon the secretions of three glands, the liver, the pancreas, and the intestinal glands.

The liver is the largest gland in the body. It produces bile which emulsifies or helps to digest fats. It also breaks down the excess amino acids from proteins and stores starch in the form of glycogen. Bile is stored in the gall bladder until needed.

The pancreas, which lies below and behind the stomach secretes both hormones, which you will study later, and several kinds of digestive juices. They neutralize the acid of the chyme, the name given to the semi-liquid food mass as it leaves the stomach. Pancreatic juices act

on starches, proteins and fats as they enter the duodenum.

The intestinal glands also secrete several enzymes which complete the breakdown of nutrients. At this stage the starches have been converted to glucose; the proteins to amino acids, the fats to fatty acids and glycerol and nucleic acids, DNA and RNA, to nucleotides. The material then passes through the cell membranes of the Villi, the finger-like projections in the intestinal wall. The indigestible material is moved by peristalsis into the large intestines.

This organ is five to eight feet long and may be 2 or 3 inches in diameter, hence the name large intestines. It's main function is to consolidate the wastes by removing water, which is reabsorbed by body tissues. Here, also, some types of bacteria break down the waste materials and release or produce valuable vitamins. The rectum is the last section of the alimentary canal or food tube. Its function is to control the release of solid wastes thru the anus or rectum.

The major concepts you should learn from this lesson are;

1. Digestion is the process of changing complex food materials into simple substances which can be absorbed through cell walls.

2. In order for materials to pass through cell walls they must be small molecules and soluble that is, dissolved in water.

3. The substances which hasten the chemical reactions in digestion are known as enzymes.

4. The major food nutrients and their final break down products are:
   a. starches - simple sugars for example glucose
   b. proteins - to amino acids
   c. fats and oils to glycerol and fatty acids.

Now read the rest of the directions on your Learning Activity Sheet and follow them carefully. If you feel you need to replay the tape you may do so, but remember other students are waiting to use it also. Be considerate of their needs.

Try to answer as many of the questions as possible without any help. Then look up the answers to the questions you do not know. You can find them on the transparency or in the guide booklet, which contains the same material that is on this tape.

When you have finished your work and had it corrected by the student leader, bring your Report Sheet and the folder you were using to me. It is YOUR RESPONSIBILITY to see that all of the materials are complete, and in good condition in the folder, before I date and initial your work.

GENERAL BIOLOGY REPORT SHEET L.A. 8.01

Name _____ Section _____ Date _____ Instructor _____

# THE DIGESTIVE SYSTEM

I. Matching Exercise IV. Answer in LETTERS.

1._____ 4._____ 7._____ 10._____

2._____ 5._____ 8._____

3._____ 6._____ 9._____

II. Completion exercise:
Write the name of the organ indicated by each letter:

1. a. d. g.

b. e. h.

c. f. i.

j.

4._____ 8._____ 12._____

5._____ 9._____

6._____ 10._____

7._____ 11._____

III. Answer questions #13 and #14 in one or two sentences each.

13._____
_____
_____
_____

14._____
_____
_____
_____

# THE DIGESTION OF NUTRIENTS

**PURPOSE:** To determine the need for digestion of nutrients and the tests to check the process. (Work in groups of 4; 3 testers and one recorder.)

**PROCEDURE:**

## PART I

1. Fill three peanut butter or tall baby food jars 3/4 full of water. Label the jars with your section, team and mark them A, B, and C.

2. Cut three pieces of cellophane tubing or sausage casing 6 inches long.

3. Tie one end of each piece of tubing with a piece of thread.

4. Fill one tube with the solution of starch, egg white and cooking oil. Tie the other end and suspend the tube in the water of Jar A. See Text, Page 219. If you are using a baby food jar, suspend one end only.

5. Fill the second tube with the salt and sugar solution. Tie the other end and suspend it in jar B.

6. One student chew on a rubber band and collect the saliva secreted in a test tube. You will need 1/3 of a tube.

7. Fill the third tube with the starch, egg white and oil solution and add the saliva that was collected. Tie the other end and suspend it in jar C.

8. Let the jars stand in the incubator in Room 253 until the next class day.

## PART II

Perform the following tests carefully and record the results in the table on your Report Sheet.

9. One student pour 1 cm. (1/2 inch) of water from jar A into 5 test tubes. Number them 1, 2, 3, 4 and 5. The second and third testers of the group do the same with jars B and C. Each of you perform the following tests on your sample. Report the results to the Recorder. (The fourth student in the group). If there is a change the test is positive so put a (+) sign in the column. If there is no change, put a (-) sign because the test is negative.

10. Pour a few drops of tube #1 on to a small piece of brown wrapping paper. Let it stand while you do the other tests. Then examine it. If a translucent spot (you can see light through) appears, fat is present in the water.

11. To tube #2 add 3 drops of Benedict's solution and heat it gently. If the solution changes color, sugar is present. It may turn green, yellow or orange depending upon the amount of sugar present.

12. To tube #3 add 1 drop of Lugol's iodine solution. If starch is present in the water, it will turn blue-black; if it is not present, the solution will be the brownish color of the iodine.

13. To tube #4 add 3 drops of Biuret solution and heat it gently. If the solution changes color, protein is present in the water.

14. To tube #5 add 2 drops of silver nitrate. CAUTION: Handle it CAREFULLY. (If you get any on you, wash it off well under running water, then tell the instructor). If a white precipitate forms. chloride ions are present, then salt has passed through the membrane.

DATA: Fill in the results of the tests on the chart on your Report Sheet.

DISCUSSION: Answer the questions on your Report Sheet using the data you obtained and the material in your Test book, pages 218-220.

CONCLUSION: From your Data and Discussion questions, draw a conclusion concerning digestion and testing of nutrients. Remember the conclusion must answer the Purpose.

GENERAL BIOLOGY LEARNING ACTIVITY 8.03

# THE DIGESTION OF PROTEIN IN FOODS

PURPOSE: To determine what substances are needed to chemically break down proteins into usable form.

PROCEDURE:

## PART I

1. Label 4 test tubes A, B, C and D.
2. Place a small cube of hard-cooked egg white in each tube.
3. Put 3 ml. of water in each tube (1½ inches).
4. Add 5 drops of hydrochloric acid (HCl) to tube A.
5. Add 1/4 teaspoon of pepsin to tube B.
6. Add 5 drops of HCl and 1/4 teaspoon of pepsin to tube C.
7. Add nothing to tube D - mark it control.
8. Mark a tall baby food jar with your section and group number.
9. Place the four test tubes in the baby food jar and put them in the incubator in Room 253 until the next class day.

## PART II

10. Examine and record the appearance of each of the test tubes.
11. Pour a small amount of raw egg white into a test tube. Add 1 cm. of water then add 3 drops of Biuret solution. Heat it gently. Observe and record the results.
12. Label 4 more test tubes $A^2$, $B^2$, $C^2$ and $D^2$.
13. Pour 1 cm. of water from each of the tubes into the 2nd test tube marked the same letter. Add 3 drops of Biuret solution to each and heat gently. Record the results.

DATA: Fill in the results of the test on the chart on your Report Sheet.

DISCUSSION: Answer the questions on your Report Sheet using the data you obtained and the material in your text book, pages 220-223.

CONCLUSION: From your data and Discussion questions, draw a conclusion concerning the digestion of proteins. Remember the conclusion must answer the Purpose.

GENERAL BIOLOGY

REPORT SHEET FOR L.A. 8.03

# THE DIGESTION OF PROTEIN IN FOODS

PART II. Question 10.

1. Examine and record the appearance of the tubes.

| TUBE | APPEARANCE* |
|---|---|
| A. | |
| B. | |
| C. | |
| D. | |

*clear-cloudy; egg white same size, larger, smaller

2. Questions 11-13

| TUBE | MATERIALS WATER-EGG & | COLOR | EXPLANATION |
|---|---|---|---|
| A. | HCl | | |
| B. | Pepsin | | |
| C. | HCl & Pepsin | | |
| D. | control | | |

3. What are the units which make up proteins?_____

4. How many of these units have been discovered?_____

5. Name the 4 elements found in these units.

A._____ B._____ C._____ D._____

6. What element is present which was not found in carbohydrates?_____

GENERAL BIOLOGY REPORT SHEET FOR L.A. 8.03

7. What enzymes act on proteins?_____

8. What liquid is needed to balance the molecules as they are broken off?

_____

9. Where does protein digestion begin in the body?_____

10. What 4 substances must be present for digestion to occur?

a._____ c._____

b._____ d._____

11. Where are the end products of protein digestion absorbed into the blood stream?_____

12. What use are protein foods put to in the body?

a._____ b._____

13. List 6 foods which have high protein content.

a._____ c._____ e._____

b._____ d._____ f._____

CONCLUSION:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

GENERAL BIOLOGY LEARNING ACTIVITY 8.04

QUIZ ON L.A. 8.01, 8.02 and 8.03 FORM A

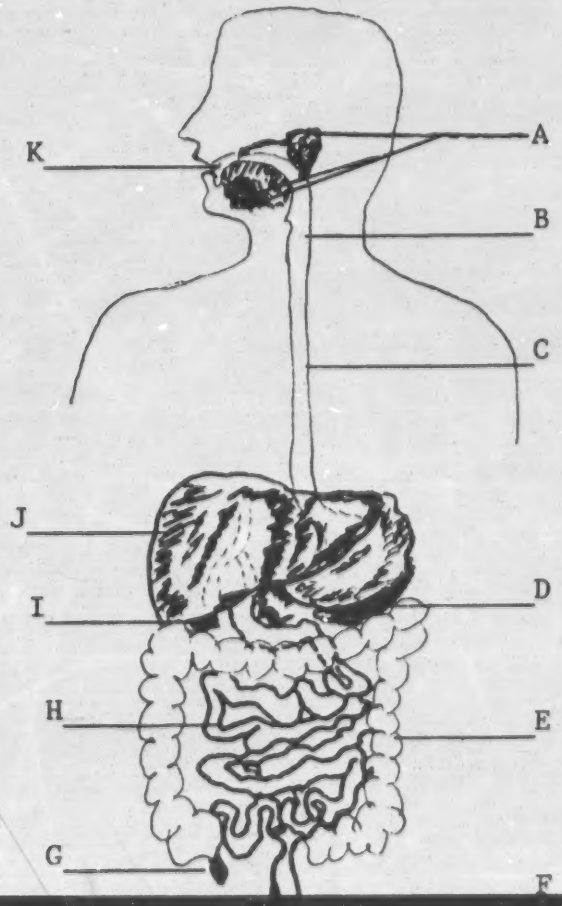
DIGESTION: THE SYSTEM AND PROCESS

I. Match the following statements and terms:

1. Enzymes which act on proteins
2. The solutions used to test for sugar
3. Starch-splitting enzymes are found in
4. What element is always present in proteins but not in carbohydrates?
5. What nutrients pass into lacteals in the velli?
6. The solution used to test for starch
7. What substance emulsifies fats?
8. The digestion of starch begins in the
9. The solution used to test for proteins
10. Substances which are essential for protein digestion in the stomach
11. The enzymes which catalyze fats and oils
12. Which substance enters the blood without requiring digestion?
13. The solution used to test for salt
14. Proteins are first broken down in the
15. The end products of protein digestion are

A. glucose
B. HCl and pepsin
C. Lugol's iodine
D. bile
E. silver nitrate
F. Amino acids
G. stomach
H. mouth and pancreas
I. proteinases
J. sucrose
K. Benedict's
L. glycerol & fatty acids
M. mouth
N. nitrogen
O. lipase
P. Biuret

II. Identify the structures by writing the name of the organ by the letter indicated on your test paper. PLEASE DO NOT WRITE ON THE QUESTION PAPER




pharynx
liver
small intestines
rectum
mouth
gall bladder
salivary glands
pancreas
large intestines
esophagus
stomach

GENERAL BIOLOGY LEARNING ACTIVITY 8.05

# pH AND DIGESTION

## INTRODUCTION:

The term pH is used to describe the acidity of solutions. It is measured by a scale which ranges from 1 to 14. The values ranging from 1 through 6 indicate an acid, with a pH of 1 the strongest acid. A pH of 7 indicates a neutral substance. Bases range from 8 to 14 with 14 the strongest base. Hydrion paper provides a convenient measure of pH.

PURPOSE: To determine the effect of pH on the digestion of some nutrients.

I. PROCEDURE:

1. Set up small test tubes. Mark them as directed.
    1. Dilute hydrochloric acid
    2. Ammonia water
    3. soda water
    4. Tap water
    5. Baking soda
    6. Freshly distilled water
    7. Magnesia

2. Measure out 10 ml of tap water and pour it into the proper tube.

3. Using the tube with water as a guide, pour approximately 10 ml of each of the other substances into the proper test tube.

4. Place the test tube rack on a piece of hand towel.

5. Tear off 7 pieces of hydrion paper each 2.5 cm (about 1 inch). Place them on the hand towel.

6. Using forceps (tweezers), dip one end of a piece of hydrion paper into each solution. Carefully lay it on the hand towel in front of the proper tube. Be sure the forceps do not get into the solution.

7. Allow the papers to dry for one minute and then compare the color with the chart on the case of the hydrion paper.

8. Record the pH of each substance on your Record Sheet.

II. 1. Collect 1/2 of a large test tube of saliva. If necessary, chew on a CLEAN rubber band. Add the o.5% starch solution to fill the test tube.

2. Place your thumb on the top of the tube, invert and shake it to thoroughly mix the saliva and starch solution.

3. Divide the solution into seven small test tubes.

4. Into 1 test tube, add drop by drop, some of the most acidic solution found in Part I, until the pH is 2.

5. In similar fashion, adjust the pH of each of the other tubes to pH's of 4, 6, 7, 8, 10 and 12, using the substances you tested in Part I.

6. Set this second set of tubes in a beaker or jar of warm water, 30-32$^{o}$C.

7. Every 3 minutes, test a few drops from each test tube with iodine until you get negative results, i.e. does not turn blue-black.

8. Record the number of minutes required to break the starch down in each tube. If there is no change after 24 minutes, stop the procedure.

DISCUSSION:

1. What is the best pH for the digestion of amylase?

2. The pH of the stomach changes due to the secretion of---. What is the pH?

3. What foods are digested in a low pH?

4. The pH of the small intestines changes because of the presence of ---.

5. What was the pH of the baking soda?

6. Is the pH of the intestine acidic or basic?

7. Why is it good to have changes in the pH in the digestive tract?

CONCLUSION:

Use your data and discussion questions to draw a conclusion concerning the effect of pH on digestion.

THE HUMAN DIGESTIVE SYSTEM
MICROSLIDE VIEWER - SET #67

DIGESTION refers to the breaking down of large, complex molecules of nutrient materials into smaller, less complex molecules that can be used by the cells of the body. The food passes through a tube, the ALIMENTARY CANAL where it is acted upon by many chemical and mechanical agents.

I. Study slide #1 on Set #67.

1. This slide is taken from the SALIVARY GLANDS. There are (a)--- pairs in the (b)---.

2. Note the tiny hollow sacs of secreting cells which produce---.

3. Locate the duct cells and study their shape. Find and draw the cross-section of a duct. (Hint: Look between 6-7 o'clock).

4. The only enzyme in saliva is (a)--- or amylase. It decomposes starch or (b)--- into maltose or glucose molecules.

II. Now study slide #3.

5. Food passes through the gullet or (a)---to the stomach. The opening is called the (b)---.

6. There are 3 kinds of tissues in this tube. The inner (a)--- layer with many (b)---to protect and moisten the tube.

7. (a)---muscle layer with circular and longitudinal muscle (b)--- to help push the food down.

8. Two (a)--- tissue layers hold the layers together. They contain (b)--- and (c)--- vessels.

III. Observe slide #6.

9. This slide shows (a)--- tissue with many (b) glands.

10. Gastric juices, (a)--- and rennin are produced by (b)--- cells whil the parietal cells produce the (c)---acid needed in digestion of (d)---.

IV. Look at slides 7 and 8.

11. The glands marked K are (a)---glands producing digestive juices. The (b)--- in these secretions complete the digestion of the nutrients.

12. The finger-like projections are called (a)---. Glucose and amino acids enter the (b)---and the larger glycerol and fatty acid molecules enter the (c)---.

13. Waste materials are pushed into the (a)---intestines, where (b)--- and some (c)---are absorbed into the blood.

14. Solid wastes are eliminated through the rectum or---.

GENERAL BIOLOGY

REPORT SHEET L.A. 8.06

# THE HUMAN DIGESTIVE SYSTEM
(Microslide Viewer #67)

Name _____ Section _____ Date _____ Instructor _____

I. The Salivary Gland slide #1.

1. a. _____

   b. _____

2. _____

3. Cross section of duct

4. a. _____

   b. _____

II. The Esophagus, Slide #3

5. a. _____

   b. _____

6. a. _____

   b. _____

7. a. _____

   b. _____

8. a. _____

   b. _____

   c. _____

III. The stomach, slide #6

9. a. _____

   b. _____

10. a. _____

    b. _____

    c. _____

    d. _____

IV. The small intestines, Slides 7 & 8.

11. a. _____

    b. _____

12. a. _____

    b. _____

    c. _____

13. a. _____

    b. _____

    c. _____

14. _____

# REVIEW OF THE DIGESTIVE SYSTEM

I. Read pages 297 to 305 in the Biological Sciences by Frazier & Smith. There are three copies in each classroom. The books are NOT to be taken from the room for ANY REASON.

II. Study the pictures and/or diagrams carefully.

III. Do the exercises below. Write the correct answer on your Report Sheet. PLEASE DO NOT MARK UP THIS PAGE.

IV. Using new words.

1. Entire food tube is known as
2. Movement of food in the food tube
3. Catalysts in the digestive process
4. Increase area of absorption in intestines
5. The area in the back of the mouth
6. Opening at the top of the trachea
7. Ringlike structures controll entrance and exit of food into & out of the stomach
8. First ten inches of the small intestine
9. Flap of tissue covering the glottis
10. Gall bladder, liver, pancreas

A. epiglottis
B. enzymes
C. pharynx
D. duodenum
E. alimentary canal
F. larynx
G. villi
H. digestive glands
I. peristalsis
J. glottis
K. vitamins
L. sphincter

V. Select the best answer.

1. Which function is NOT performed by the liver?
   (a) synthesis of some proteins
   (b) storage of sugar as glycogen
   (c) production of red blood cells
   (d) production of bile
2. The pancreas produces digestive juices and
   (a) thyroxine (b) insulin (c) adrenalin (d) glucose
3. Carbohydrates must be changed to --- to be used by cells.
   (a) sucrose (b) maltose (c) glucose (d) lactose
4. The end products of protein digestion are
   (a) fatty acids (b) amino acids (c) glycerol (d) starches
5. Bile aids in digestion of fats and oil because it --- fats.
   (a) emulsifies (b) melts (c) liquifies (d) burns

6. Two pancreatic enzymes which digest proteins
   (a) bile and trypsin (c) bile and glycerol
   (b) lipase and chymotripsin (d) trypsin & chymotripsin

7. The primary source of building materials is
   (a) fats and oils (c) proteins
   (b) starches (d) sugars

8. Teeth and bones and DNA & RNA all require
   (a) phosphorus (b) iodine (c) iron (d) calcium

9. Organic compounds is essential to normal metabolism, but which we cannot make
   (a) fats (b) vegetables (c) vitamins (d) sugars

10. Roughly two-thirds of the body weight is due to
    (a) bone (b) muscle (c) fat tissue (d) water

GENERAL BIOLOGY

LEARNING ACTIVITY 8.08

# ENZYME ACTIVITY

Name _____ Section _____ Date _____ Instructor _____

**PROBLEM:** How does tissue enzyme catalase function?

**INTRODUCTION:** Hydrogen peroxide is a poisonous product of metabolism. Many times tissues contain an enzyme, catalase which disposes of hydrogen peroxide by accelerating this reaction.

$$\underset{\text{hydrogen peroxide}}{2\ H_2O_2} \xrightarrow{\text{catalase}} \underset{\text{water}}{2H_2O} + \underset{\text{oxygen}}{O_2}$$

**PROCEDURE:**

1. Arrange 6 test tubes in a rack. Label them #1 through #6.
2. Put a small amount of the following substances into proper tube.
   #1. sand #3. liver #5. chalk
   #2. potato #4. spinach #6. fat.
3. Prepare a 1-hole rubber stopper, glass tube, rubber tube and 250 ml. beaker of water as shown in your text, Page 230.
4. Pour one inch of hydrogen peroxide into tube #1, stopper it and count the number of bubbles which escape into the water for one minute.
5. Repeat step #4 with each test tube. Record your results on the chart below.

**OBSERVATION:**

The number of bubbles produced per minute are listed below:

| | Bubbles/min. | | Bubbles/min. |
|---|---|---|---|
| #1. sand | --- | #4. spinach | --- |
| #2. potato | --- | #5. chalk | --- |
| #3. liver | --- | #6. fat | --- |

1. Why did some substances show no reaction? _____
2. What was the purpose of using them? _____
3. What kind of substances seemed to contain catalase? _____
4. Which substance was most reactive? _____

**CONCLUSION:** 1. I conclude that _____ and _____ contain the enzyme catalase and increase the _____ of the chemical breakdown of _____ in the living cells.

GENERAL BIOLOGY PROGRESS SHEET #4

Name Section Date Instructor

## PHYSIOLOGY 700 EXERCISES

N.B.

1. These exercises must be done in groups. You will have three or four weeks; 9-12 classes and 15-20 nights for home study.

2. You may begin with either group A or B.

3. Do the first two exercises; study the material carefully and then ask for the quiz. Then begin the other group.

4. Group C is extra for those students who are especially interested &/or rapid workers.

5. The date for the Unit Test will be announced. If you are absent, it is up to you to catch up and complete at least Groups A & B before the test day.

| NO. | TITLE | DESCRIPTION | CHECK | COMMENT |
|---|---|---|---|---|
| 7.01 | The Skeletal System | Tape | | |
| 7.02 | Composition of Bone | Lab. | | |
| 7.05 | Skeletal System & Bone | Quiz | | |
| 7.03 | Epithelium & Cartilage Tissues | Microviewer #50 | | |
| 7.04 | Connective, Blood & Nerve Tissue | #51 | | |
| 7.06 | Various tissues | Quiz | | |
| 7.07 | Review of Skeletal & Muscular System | Reading | | |
| 7.10 | Test on Skeletal System | | | |
| | E X T R A | | | |
| 7.50 | Muscular System | Tape | | |
| 7.51 | Types of Muscles | Microviewer #51 | | |
| 7.52 | Muscles | Quiz | | |
| | | | | |
| | | | | |
| | | | | |

# THE SKELETAL SYSTEM

I. Listen carefully to the tape

II. Study the bones of the skeleton. You will be expected to be able to label the major bones on a diagram.

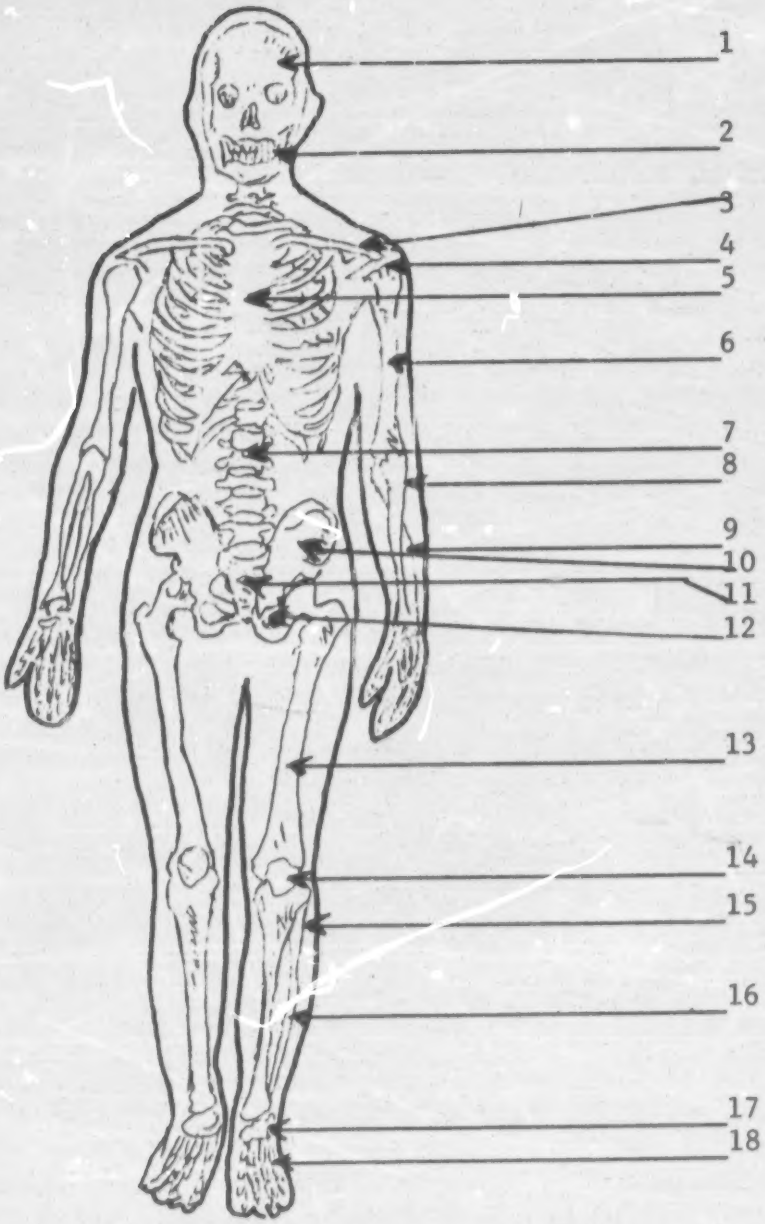
III. Study the transparency of the skeleton and the flash cards before you try this question. Look at the diagram of the skeleton. You have both the front and back view to help you locate the bones. Try to label the bones without looking at the transparency.

IV. Answer the questions on your Report Sheet

PLEASE DO NOT PUT ANY MARKS ON THESE SHEETS

V. Complete the statements on Page 1 by using one of the following words or groups of words. Write the number of the correct answer on your Report Sheet.

1. Liver, kidney and stomach
2. organs of lower abdomen
3. ball-and-socket
4. lower jaw bone
5. thoracic cage
6. breastbone
7. lungs and heart
8. stiff and awkward
9. vertebrae
10. ligament
11. spinal cord
12. knee cap
13. hinge joint
14. brain
15. epiphysis
16. knee joint
17. nervous
18. hinges
19. disc
20. ribs


1
2
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TAPE SCRIPT L.A. 7.01

# THE SKELETAL SYSTEM

The skeletal system of man consists of cartilage, ligaments, and a skeleton of 206 bones. CARTILAGE is a soft slippery material at the end of many bones. The nose and outer ear are also made of cartilage. LIGAMENTS are strong bands of connective tissue which bind bones together at joints.

A bone is composed of non-living calcium phosphate and calcium carbonate secreted by bone cells. The living part of the bone consists of bone cells, cartilage cells, blood, blood vessels, nerves, fatty material and connective tissue.

Many bones, especially the long bones of the limbs have enlarged ends made up of Spongy Bone containing RED BONE MARROW where red blood cells and some white blood cells are made. Cartilage covers the ends of the bone. The long narrow part is made of COMPACT BONE containing YELLOW BONE MARROW for fat storage and is covered with a tough membrane called the PERIOSTEUM. The growth of the long bones occurs at both ends, between the compact bone and the spongy bone. This region is known as the EPIPHYSIS.

The size and shape of the bones vary greatly and are closely related to their specific function. The skull consists of the CRANIUM, made up of several joined bones and the facial bones. The lower jawbones are the only movable ones.

The back bone or VERTEBRAL COLUMN is made up of 33 separate hollow VERTIBRAE linked together by ligaments. Cartilage pads or discs are located between each vertebra and function as shock absorbers. The SPINAL CORD, or major nerve of the body lies in the canal formed in the hollow of the vertebral column. The COCCYX or tailbone is made up of 4 or 5 small joined vertebrae.

The breastbone or STERNUM has two functions. The upper region connects the two CLAVICLES or collar bones and the lower part is the front attachment for the RIBS. These together are called the THORACIC or RIB CAGE and protect the heart and lungs and partially protect the liver, kidneys and stomach.

The bones of each pair of limbs are attached to a ringlike set of bones called a girdle. The arms are attached to the PECTORAL girdle which consists of the clavicles and scapulas. They are held in place by ligaments. The legs are attached to three pairs of fused bones called the PELVIS, or hip bone. The top or head of the FEMUR is held in the socket by ligaments.

THE SKELETAL SYSTEM

The bones of the arms and legs compare well with each other. Each has 3 long bones. In the arm - we find humerous, ulna and radius; in the leg - the femur, tibia and fibula. The wrist bones are carpals, the hand bones metacarpals, the ankle bones are known as tarsals, the foot bones metatarsals. The finger and toe bones are called phelanges. The leg has an extra small bone at the knee known as the PATELLA or knee cap.

The junctions between bones are called joints. There are two major types - MOVABLE and IMMOVABLE. Immovable joints do not permit movement but do provide protection. The cranium protecting the brain and pelvic girdle protecting the lower abdominal organs are immovable joints.

The movable joints are divided into four major types. The BALL-AND-SOCKET joint found in the hip and shoulder joints permit movement in all directions. A PIVOT JOINT allows one bone to rotate on another. The skull pivots on the first vertebrae when you turn your head. Some of the wrist and ankle bones rotate on each other. The vertebrae and some others of the carpals and tarsals are examples of gliding joints. That is, the glide across each other. The hinge joints found in the elbows and knees permit movement in one direction only, just as the hinges on doors usually open in one direction only.

The growth of bones depends upon diet and gland function. Calcium and phosphorous are two essential minerals. Vitamin D is needed to utilize the minerals. The growth and development of bone tissue is also partially controlled by the pituitary, thyroid, parathyroid and sex glands. You will learn more about these glands in another lesson.

The major concepts you should learn from this lesson are:

1. The skeletal system provides the framework for the body, giving it shape and support.

2. The bones provide a place of attachment of muscles to permit motion.

3. Parts of the skeleton also provide protection to vital organs of the body. The cranium protects the brain and the thoracic or rib cage protects the heart and lungs.

Now read the rest of the directions on your Learning Activity Sheet and follow them carefully. If you feel you need to replay the tape you may do so, but remember other students are waiting to use it also. Be considerate of their needs.

Try to answer as many of the questions as possible without any help. Then look up the answers to the questions you do not know. You can find them on the transparency or in the guide booklet, which contains the same material that is on this tape.

## THE SKELETAL SYSTEM

When you have finished your work and had it corrected by the student leader, bring your Report Sheet and the folder you were using to me. It is YOUR RESPONSIBILITY to see that all of the materials are complete, and in good condition in the folder, before I date and initial your work.

# THE HUMAN SKELETON

1. There are more than (100, 200, 150, 75) bones in a skeleton. To make your skeleton strong and useful, your bones have different shapes and various ways of being joined together. For instance:

2. The skull is made up of 22 bones, but only 1 is movable; it is the mandible or the _____.

3. This bony structure (the skull) protects the _____.

4. To the sternum or the _____ are fastened most of the _____. These bones form the _____ cage.

5. This _____ cage protects the _____ and to some extent the _____.

6. Some bones do not look like a "regular" bone, but are flat, like the patella or the _____ which protects the _____.

7. Your knees and elbows have joints that work like _____, so they are called _____ joints.

8. Your shoulders and hips have joints that allow a rolling motion, made possible by the use of _____ joints.

9. The pelvic bones support and protect _____.

10. Your spinal column is made up of 33 bones, 26 of which are flexible bones called _____.

11. If your backbone were one solid bone, how would this affect your movements? _____?

12. Your spinal column is also a canal or passageway for the _____ _____ which, with the brain makes up the central _____ system.

13. A very strong cartilage forms a sort of cushion between each two vertebrae. This cushion is called a _____.

14. The cartilage is not the only means of fastening the vertebrae together: nature also used _____.

15. How can bones grow as the body grows? _____

GENERAL BIOLOGY

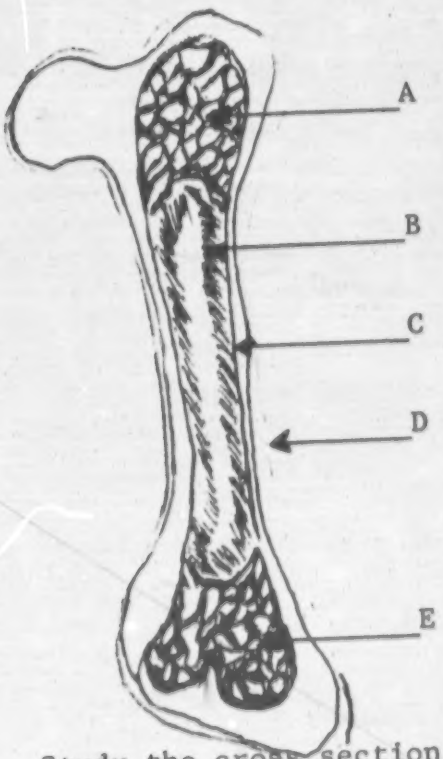
LEARNING ACTIVITY 7.02

# THE STRUCTURE AND COMPOSITION OF BONE

PURPOSE: To study the structure and composition of bone

PROCEDURE:

1. Study the diagram of the bone in your textbook Page 212.
2. Label the structures indicated below and match the structure with the function.




A.
1. Compact bone
2. periosteum
3. red bone marrow
4. yellow bone marrow
5. spongy bone

B.
1. membrane covering the bone
2. strong supporting tissue
3. softer, porous part of bone
4. production of red blood cells
5. nutrients for living tissue

3. Study the cross section of a bone cell in the Microviewer Slide Set #10, Slide #4 or Set #51, slide #5.
   a. On your Report Sheet, draw a picture of the slide and label the three parts.
   b. Name the structures A and B and give the function of each.

4. Test a small piece of bone for carbonates. (Carbonates are compounds composed of a mineral, and carbon and oxygen atoms. When placed in an acid carbon dioxide molecules bubble off.)
   a. Place a small piece of bone in a small baby food jar.
   b. Carefully cover it with 12N hydrochloric acid (HCl) solution.
   c. Observe the reaction. HANDLE THE ACID CAUTIOUSLY.
   d. Study the table on Page 210 and then list three elements which may be found as carbonates in bone tissue.

5. Weigh a small dry bone.
   a. Record the weight on your Report Sheet.
   b. Place the bone in a 12N HCl solution in a tall baby food jar (covered and labeled) for three days.

c. Remove the bone from the solution with forceps (tweezers). DO NOT TOUCH it with your fingers.

d. Rinse off the bone with tap water. Lay it on a hand towel to dry.

e. re-weigh the bone.
   1. What is the difference in the weight?
   2. What part of the bone has been removed?

f. Feel the bone.
   1. Does it feel hard or soft (like cartilage)?
   2. Explain briefly.
   3. What is cartilage?
   4. What makes bones hard?

g. Test the bone for protein.
   1. Cut off a small piece of the bone.
   2. Place it in a pyrex test tube.
   3. Add 2 ml. of water.
   4. Add 2 ml. of Biuret solution. (Biuret solution is a test for the presence of protein. If protein is present, the solution changes color.)
   5. Heat the tube for a minute or two and watch for a color change.

CONCLUSION:

The conclusion of an investigation must answer the Purpose at the beginning for example:

1. We conclude that the three major structures of bones are---(a), and a spongy --- (b) which are covered by a thin ---(c).

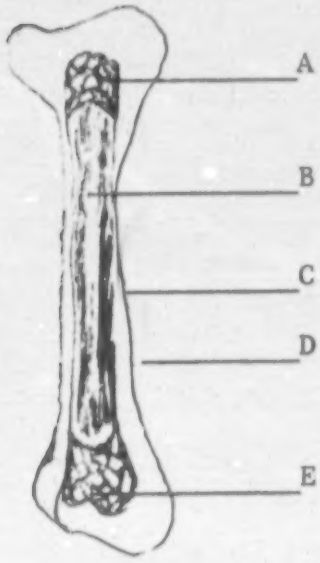
2. From our tests, we conclude that bone contains carbonates of (a)---, (b)---, (c)--- and the building material (d)---.

# THE STRUCTURE AND COMPOSITION OF BONE

DATA:

2. A. Label the structures indicated on the diagram and

B. match the structure with the function.




A. USE LETTERS

1. compact bone _____
2. periosteum _____
3. red bone marrow _____
4. yellow bone marrow _____
5. spongy bone _____

B.

1. membrane covering the bone _____
2. strong supporting tissue _____
3. softer, porous part of bone _____
4. production of red blood cells _____
5. nutrients for living tissue _____

3. Cross section of bone

A. _____

B. _____

4. What happened when the piece of bone was placed in the HCl acid?

(c) _____

Why? _____

d. Three elements which may be found as carbonates in bone tissue are

1._____ 2._____ 3._____

5. The weight of the bone placed in HCl

a. before

b. after

Difference in weight:

The_____had been removed from the bone while in the HCl solution.

g. After heating the Biuret solution was _____ proving that protein _____present.

f. 1._____

2. (b)

3._____

4._____

_____

CONCLUSION:

1. We conclude that the three major structures of bones are (1) _____ _____(2)_____which are covered by a thin (3)_____.

2. From our tests we conclude that bone contains carbonates of (1)_____(2)_____and (3)_____and the building material_____.

GENERAL BIOLOGY LEARNING ACTIVITY 7.03

# EPITHELIUM AND CARTILAGE TISSUE
(Microslide Viewer Set #50)

1. The body is composed of billions of cells or building blocks. These cells are not all alike. You have many different kinds of cells because they must do different kinds of work to keep the body alive. Different kinds of cells working together are known as a tissue. Several tissues working together make an organ and several organs working together to produce one function are known as a system.

2. In this lesson, we will study several tissues to see how different kinds of cells work together.

3. Study Slides #1 and #2 on Microviewer Set #50.
   a. Draw two cells of the lining of the trachea.
   b. In slide #2, what does the letter A point out?
   c. What kind of tissue holds other tissues together?

4. Look at Slide #3.
   a. What are the dark blue spots on the slide?
   b. What is the lining tissue called?
   c. What are the tiny hair-like structures? What is their function?
   d. Draw two of these cells.
   e. What is the name of these cells?
   f. How did they get their name?

5. Look at Slide #4.
   a. What is the group of cells marked G called?
   b. What is its function?
   c. How does this secretion help the body?

6. Look at Slide #5.
   a. What is the name of the tissue making up the hard ring?
   b. Why is it important to have this type of tissue in the trachea?

7. Look at Slide #6.
   a. What is the scientific name for the food tube?
   b. What are the two kinds of cells in the food tube? Give the function of each.

8. Look at Slide #8.
   a. How do the epithelial cells in this slide differ from those seen in others?
   b. What type of muscle cells are found in the urinary bladder?

GENERAL BIOLOGY LEARNING ACTIVITY 7.04

# CONNECTIVE BLOOD AND NERVE TISSUE
(Microslide viewer Set #51)

1. The cells of the body are grouped together into tissues, organs and systems. The various structures are held together by a network of tissues. All of these tissues are called connective tissue though they vary in size, shape and function. We have already studied bone cartilage and epithelial tissue. Today we will study three more kinds of tissues.

2. a. Look at slide #4 and slide #7. These cells bind other cells together so are known as ---- tissue.
   b. The areolar tissue holds the skin and --- tissue below it together.

3. Draw two adipose (fat) cells on your Report Sheet.

   a. What food nutrient is stored in these cells?_____

   b. Where is the nucleus located?_____

   c. What effect does an increase in weight have on the blood vessels?_____
   _____.

   d. Is this good or bad? Why?_____
   _____
   _____
   _____

4. Look at Slide #6.
   a. What are the two types of blood cell?

   b. How do these cells differ in structure and function?

5. Draw one of each type of blood cell.

6. Look at Slide #8.
   a. This slide shows a view of ---- tissue.

   b. Nerve cells are often called ---.

   c. The nucleus of a nerve cell is found in the ---.

   d. Nerve tissue is found in the ----; the spinal------ and nerves of the body.

7. Draw a nerve cell.

GENERAL BIOLOGY LEARNING ACTIVITY 7.07

# REVIEW OF THE SKELETAL AND MUSCULAR SYSTEMS

I. Read Pages 276 to 292 in the Biological Sciences by Frazier and Smith. (There will be 3 copies in each classroom. The Books are not to be taken from the room for any reason WHATSOEVER).

II. Study the pictures and/or diagrams carefully.

III. Do the exercises below. Write the correct term on your Report Sheet. Please DO NOT MARK UP THIS PAGE.

1. Many stimuli or nervous impulses produce a contraction of a muscle which is knows as tonus tetanus insertion

2. In the joints which permit movement, bones are held together by tissue called ligaments tendons periosteum

3. Bones of the skull which are joined by immovable joints to protect the brain are collectively called the
cranium centrum sternum

4. A type of muscle which functions almost constantly is called a
smooth skeletal cardiac muscle

5. The protection of the spinal cord in the human body is provided by thirty-three structures called
periosteum vertebrae muscle

6. The pigment in the skin which helps to protect the body from the harmful effects of the sun's rays is called
dermis hemoglobin melanin

7. The bony case surrounding the brain is not fully developed in an infant. At birth, the cranium is mostly composed of
cartilage bone muscle

8. The skin protects the body from disease, from ultraviolet rays, from heat loss, from blows to the body and from the excessive loss of: heat water vitamins

9. The kind of muscle which can remain contracted or almost completely relaxed for long periods of time is called --- muscle.
skeletal cardiac smooth

10. Cells in the lower layer of the dermis which help to insulate the body are called --- cells.
effectors melanin receptors

IV. Using New Words

| | |
|---|---|
| 1. supports for the arms | A. origin |
| 2. structure from which a hair grows | B. axial skeleton |
| 3. redness and swelling of the skin | C. pelvic girdle |
| 4. skeleton containing arms and legs | D. follicle |
| 5. skeleton containing skull and ribs | E. insertion |
| 6. type of muscle of stomach & intestines | F. dermatitis |
| 7. type of muscle in heart | G. dehydration |
| 8. striated muscle are also known as | H. pectoral girdle |
| 9. lack of enough water in living tissue | I. smooth muscle |
| 10. places of attachment of biceps muscle | J. skeletal muscle |
| | K. cardiac muscle |
| | L. appendicular skeleton |

GENERAL BI[illegible] LEARNING ACTIVITY 7.5

# THE MUSCULAR SYSTEM
(Optional Material)

I. Listen carefully to the tape.

II. You will not be expected to memorize the names of the muscles, but it is important that you understand how the skeletal muscles function.

III. Study the transparency and the flash cards carefully then see if you can do the two matching exercises and the completion exercises. Write your answer on your Record Sheet.

PLEASE DO NOT PUT ANY MARK ON THIS SHEET.

IV. Match the definitions and structures:

| | |
|---|---|
| 1. Muscles under control of the will | a. tendon |
| 2. Muscles which bend the body joints | b. ligament |
| 3. Involuntary muscles | c. voluntary |
| 4. Attachment to bone which moves | d. insertion |
| 5. Connects muscle to bones | e. involuntary |
| 6. The heart muscle | f. flexor |
| 7. Triceps muscle is a --- | g. extensor |
| 8. Connect one bone with another bone | h. striated |
| 9. Originates constrictions of the heart | i. smooth |
| 10. Muscles which have stripes | j. pacemaker |
| | k. origin |
| | l. cardiac |

GENERAL BIOLOGY LEARNING ACTIVITY 7.50

V. Match the following muscles and their function. Use LETTERS for your answers. You may use an answer more than once.

| | |
|---|---|
| 1. Rotates & Lowers the head | a. tibialis anterior |
| 2. Raise the forearm | b. triceps |
| 3. Extends the leg | c. sartorius |
| 4. Pulls in the abdomen | d. gastrocnemius |
| 5. Rotates the thigh | e. sternocleidomastoid |
| 6. Lowers the arm | f. greater pectoral |
| 7. Flexes the foot and leg | g. biceps |
| 8. Raises the front of the foot | h. rectus abdominis |
| 9. Lifts the ribs | i. rectus femoris |
| 10. Raises and rotates the arm | j. deltoid |

IV. Completion exercise - How the Muscles Work - on next page.

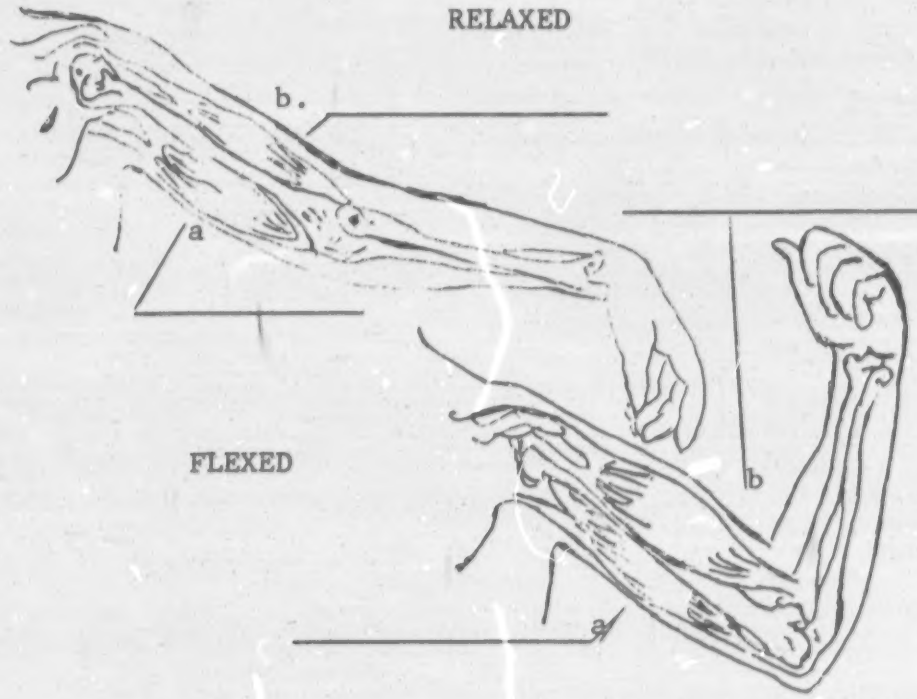
GENERAL BIOLOGY L.A. 7.50

## HOW THE MUSCLES WORK

1. The body, like all living things, is made up of millions and millions of _____.

2. Cells have many different shapes. One cell is made up of long, slender fibrils and is called a _____

3. A number of such cells fused or "bound together" become a _____ fiber. Draw your conception of a cross section of a muscle, showing bundles of muscle cells.




4. These drawings show the flexed arm and the relaxed arm. On each one locate the <u>biceps</u> and the <u>triceps</u> muscles. (a) is the _____; (b) is the _____

5. What makes the muscle "bulge" in the middle?_____

_____

6. Does a muscle pull or push a bone?_____

7. Can a muscle do both?_____

8. For every muscle that raises a bone, there is an opposite_____

_____

TAPE SCRIPT L.A. 7.50

# THE MUSCULAR SYSTEM
(Optional Material)

In humans and many other kinds of animals, the ability to move depends upon the interaction of the skeletal system and the muscular system.

Muscles are divided into three groups. Voluntary muscles which are controlled by the will; involuntary muscles which are so named because they are not under conscious control; and the heart muscle.

The voluntary muscles are attached to the bones of the skeleton and move them, therefore they are often called skeletal muscles. They are long, round and cross-striped so they are also know as striated muscles. Each end of a muscle is attached to a bone by a band of especially strong connective tissue called a Tendon. The end attached to the bone which does not move is called the origin. The end attached to the bone which does move is called the insertion. The main part of the muscle is known as the belly.

Most skeletal muscles work in opposing pairs. That is, as one muscle contracts the opposing muscle relaxes. Take, for example, the muscles in the upper arm. When a boy wants to display his upper arm muscles he pulls his forearm up which shortens his biceps muscle and the enter or belly bulges out. At the same time the triceps muscle underneath the arm relaxes. Muscles that bend a part of the skeleton are called flexors; those that return the bone to the original position are known as extensors. Hence the biceps muscle is a flexor and the triceps an extensor.

The involuntary muscles are smooth, non-striated and spindle shaped. Each has one large central nucleus. Smooth muscles are usually arranged in sheets or layers. They are found principally in the internal organs, for example in the digestive tract, respiratory passage, urinary and gall bladders and in the walls of the blood vessels. A few of the involuntary or smooth muscles are sometimes under voluntary control, for example the diaphragm and eyelids.

The heart or Cardiac muscle belongs in a group all its own. Its cells have some of characteristics of the voluntary muscles in so far as they have some striations, however, the heart muscle is not under conscious control. The contraction of the heart originates in a small group of cells in the right auricle known as the pacemaker. This mass of cells resembles nerve tissue as it can set up and transmit electro-chemical impulses to other parts of the heart.

There are more than 800 muscles in the human body. You may be interested in knowing the functions of a few. Let's look at those shown on the transparency.

TAPE SCRIPT L.A. 7.50

# THE MUSCULAR SYSTEM
(Optional Material)

The sternocleidomastoid rotates and depresses the head. The deltoid muscle raises and rotates the arm. The biceps raise or flexes the forearm and the triceps lower or extend it. The greater pectoral muscle lifts the ribs and pulls the arm toward the chest. The rectus abdominis is one of the three layers or sheets of muscle in the abdominal region. It compresses the abdomen. The rectus femoris extends or straightens the leg and the sartorius muscle rotates the thigh when you cross your legs. The gastrocnemius flexes the foot and leg when you raise your heel and the tebiales anterior flexes or raises the front of your foot. Moderate exercise helps keep muscles in good condition. The actual movement of muscles depends upon stimuli from the motor neurons of the nervous system which you will study later.

The major concepts you should learn from this lesson are:

1. There are three kind of muscles - voluntary, involuntary and heart muscle.

2. The voluntary muscles are attached to the skelton and are responsible for movement.

3. Involuntary muscles control the functions of most of the internal organs and systems eg. digestion, circulation, glands etc.

4. The heart is composed of a special type of muscle.

Now, read the rest of the directions on your Learning Activity Sheet and follow them carefully. If you feel you need to replay the tape you may do so, but remember other students are waiting to use it also. Be considerate of their needs.

Try to answer as many of the questions as possible without any help. Then look up the answers to the questions you do not know. You can find them on the transparency or in the guide booklet, which contains the same material that is on this tape.

When you have finished your work and had it corrected by the student leader, bring your Report Sheet and the folder you were using to me. It is YOUR RESPONSIBILITY to see that all of the materials are complete, and in good condition in the folder, before I date and initial your work.

# TYPES OF MUSCLE (Optional)
(Microviewer #51 and Text, Page 215)

PURPOSE: To study muscle tissue and compare the structures and functions of each type.

PROCEDURE:

## PART I

1. Study slide #1 on microviewer set #51.
2. Draw one cell; name it and label the parts indicated.
3. Why are these cells given that name?
4. What structure is found at A?
5. What are the long threads of cytoplasma called?
6. Some sections of the muscle are thin, others thick, this makes the cell look striped so they are also known as ---.
7. These muscles move the bones so they are given a third name.
8. Explain briefly how muscles move the bones.
9. Study Slide #2 on Microviewer Set #51.
10. Draw one cell, name it and label the parts indicated.
11. Why are these cells given that name?
12. They are often given another name because of their appearance. What is it?
13. Name three places in the body where this type of muscle may be found.
14. Study Slide #3 on Microviewer Set #51.
15. Draw one cell; name it and label the parts indicated.
16. Where is this type of cell found in the body?
17. How does it resemble the voluntary muscle cells?
18. Because it functions slowly and for long periods of time, it also resembles --- muscles.

## EXTRA CREDIT PART II

1. Bring in a tiny piece of raw pork chop or a small piece of beef or lamb from a roast - not ground beef.
2. Make a slide of muscle tissue as directed in your Text, Page 214.
3. When you have finished the slide, draw what you see and have me initial it.

DATA AND DISCUSSION: See the Report Sheet.

CONCLUSION:

From what you have learned about muscle tissue, make up 1 or 2 sentences which answer the purpose of the experiment.